

Direct Drive Linear Motor

Selection Guide



KOLLMORGEN

A REGAL REXNORD BRAND

Kollmorgen: Your Partner, In Motion.

Every solution comes from a real understanding of the challenges facing machine designers and users.

Innovators consistently rate Kollmorgen as one of their best motion systems manufacturing partners. Whether you are looking for classic servo motors, direct-drive servo motors, stepper motors, drives & amplifiers, gearing, actuation, or multi-axis motion controllers, Kollmorgen is one of the few companies in the world that actually designs and manufactures all of these products.

Our customers are leaders in many industries such as Aerospace & Defense, Printing, Packaging & Converting, Food & Beverage Processing, Medical Imaging, In Vitro Diagnostics & Laboratory Automation, Pharmaceutical Manufacturing, Material Forming and Cutting, Oil & Gas, and Robotics. Kollmorgen is also a leader in Warehouse Automation, including complete AGV systems, software, awareness and autonomy.

Our Automation Solutions can be found on Mars and in space, ships and submarines, O&G drilling and metrology, surgical robots and laser eye surgery, even inside artificial hearts. These are just a few applications that demand high-performance and high-quality while satisfying their specific needs.

Because motion matters, it's our focus: Motion can distinctly differentiate a specific machine and deliver a marketplace advantage by increasing its performance and dramatically improving Overall Equipment Effectiveness (OEE).

High-performance motion can make your customer's machine more reliable and energy-efficient, enhance accuracy and improve operator safety. Motion also represents endless possibilities for innovation.

We've always understood this potential, and thus have kept motion at our core and in our Vision, Mission & Values, relentlessly developing products that offer precise control of torque, velocity and position accuracy in machines that rely on complex motion.

Removing the Barriers of Design, Sourcing, and Time

At Kollmorgen, we know that OEM engineers can achieve a lot more when obstacles aren't in the way. So, we clear obstacles in three important ways:

Integrating Standard and Custom Products

The optimal solution is often not clear-cut. Our application expertise allows us to modify standard products or develop totally custom solutions across our whole product portfolio so that designs can take flight.

Providing Motion Solutions, Not Just Components

As companies reduce their supplier base and focus their engineering manpower on the product design, they need a total system supplier with a wide range of integrated solutions. Kollmorgen offers complete solutions as well as motion subsystems that combine programming software, engineering services and best-in-class motion components.

Global Footprint

With direct sales, engineering support, manufacturing facilities, and distributors spanning the Americas, Europe, the Middle East, and Asia, we're close to OEMs worldwide. Our proximity helps speed delivery and lend support where and when they're needed.

Financial and Operational Stability

Kollmorgen is part of Regal Rexnord. A key driver in the growth of all Regal Rexnord segments is the Regal Rexnord Business System, which relies on the principle of "kaizen" – or continuous improvement. Using world-class tools, cross-disciplinary teams of exceptional people evaluate processes and develop plans that result in superior performance.

Kollmorgen: Your partner. In Motion.

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Direct Drive Linear (DDL) Motor

Our direct drive linear motor series provide new dimension in performance with high throughput, accuracy, and zero maintenance.

The product line are frameless, permanent magnet, three phase, brushless servo motors. The DDL product line consists of two fundamental constructions, Ironless (slotless) and Ironcore. Ironless motors have no attractive force between the frameless components and zero cogging for the ultra smooth motion. Ironcore motors provide the highest force per frame size. They feature a anti-cogging design which yields extremely smooth operation. Optional water cooling provides flexibility to increase continuous force in the same profile.



The Benefits of Direct Drive Linear Motor

-
- » **Flexibility and Compatibility for Global Industry Automation Applications**
 - » Ironcore IC DDL supports 230/400/480 VAC power supply
 - » Ironcore IC and Ironless IL DDL fits CE, UL, RoHS and Reach certifications
 - » Ironcore ICD DDL provides a compact profile. Ironless IL DDL provides zero cogging for high dynamic advantages. Both work at 230 VAC power supply.
 - » Premium performance achieved with Kollmorgen AKD®/AKD®2G servo drives. The time and frequency domain tuning tools provide premium and stable performance.
 - » **Zero Maintenance with Greater Accuracy and Higher Bandwidth**
 - » Smoother velocity and reduced audible noise
 - » Power transmission without backlash
 - » Transmission elements such as couplings, toothed belts, ball/lead screws, rack & pinions, and other fitted components can be eliminated
 - » No gears or screws, no lubrication required
 - » Improved machine reliability
 - » **Wide Range of Sizes and Force to Cover any Linear Application**
 - » Increased performance for the entire system
 - » Flat, compact drive solution
 - » Easily mix / match motors and drives
 - » Real-life acceleration up to 10 G
 - » **Simplified, High Force Permanent Magnet Design**
 - » Higher bandwidth and faster response than ball/lead screws or rack & pinion solutions
 - » Rapid indexing of heavy loads with peak force up to 12,705 N (2,856 lb)
 - » Reduced audible noise, fewer parts and lower cost of ownership
 - » More compact machine design
-



REACH ✓

► Direct Drive Linear (DDL) Motor

Kollmorgen Direct Drive Linear DDL Motor Series

Kollmorgen supplied its first linear motors in the late 1970's for use in precision X-Y tables and coating systems. These were brush DC motors using the Kollmorgen push-through commutator bar method. This led to development in the early 1980's of the brushless versions of the linear motor which were used in film processing applications where smooth, high stiffness, linear motion was required. During the past 30 years, advances in permanent magnet material, power semiconductors, and microprocessor technology have been the enablers for increased performance and lower costs for linear motors.

DDL motors series comply with the Low Voltage Directive 73/23/EEC for installation in a machine. Safety depends upon installing and configuring motor per the manufacturer's recommendations. The machine in which this product is to be installed must conform to the provisions of EC directive 89/336/EEC. The installer is responsible for ensuring that the end product complies with all the relevant laws in the country where the equipment is installed.

Standard Product Features

Ironless:

- » Peak force 30 to 1600 N (6.7 to 360 lbf)
- » Continuous force 10 to 262 N (2.3 to 59 lbf)
- » Zero cogging
- » Zero attractive force
- » Smooth motion for speed as low as 1 micron/second (0.00004 in/sec)
- » Low mass coil assembly for high acceleration

Ironcore:

- » Natural-cooled IC series:
 - Peak Force: 369 to 13448 N (83 to 3023 lbf)
 - Continuous Force: 140 to 5834 N (31.5 to 1312 lbf)
- » Water-cooled IC series:
 - Peak Force: 384 to 12705 N (86 to 2856 lbf)
 - Continuous Force: 251 to 8211 N (56 to 1846 lbf)
- » ICD series:
 - Peak force: 165 to 1099 N (38 to 254 lbf)
 - Continuous: 57.0 to 315 N (12.8 to 70.8 lbf)
- » Anti-cogging technique for minimal cogging without magnet skewing
- » High motor constant (Km)
- » High force density
- » ICD series advantage:
 - Very low profile
 - Low attraction force
 - Suitable to replace many Ironless applications

All Motors:

- » Zero contact, zero maintenance, brushless design
- » 3 phase sinusoidal commutation
- » Peak accelerations easily above 10 G
- » High position accuracy and resolution
- » Very low settling time
- » Low thermal losses
- » Modular magnet design

Standard Options:

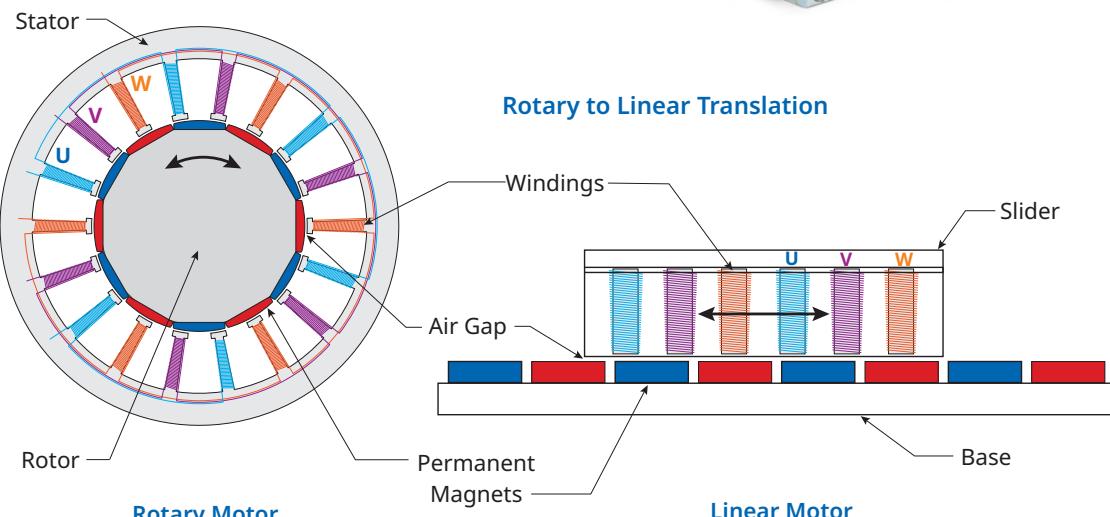
- » Hall effect feedback
- » Thermal protection
 - Thermistor (PTC)
 - Thermostat (Thermal switch) (Ironcore)
 - PT1000 (Ironcore)
- » Supplemental air or water cooling (Ironcore)
- » Magnet way covers for easy cleaning (Ironcore)

Kollmorgen Direct Drive Linear DDL Servo Motors

Our Direct Drive Linear (DDL) motor series are frameless permanent magnet, three phase brushless servo motors. Fundamentally, a linear motor is a rotary motor that is rolled out flat.



Direct Drive Linear Motor Series with AKD® Family Servo Drives



Rotary Motor Rolled Out Flat

The two primary components of permanent magnet brushless rotary motors are the stator (primary coils) and the rotor (secondary or rotating magnets). In brushless linear motors the rotor is rolled out flat to become the magnet track (also called the magnet way). The primary coils of the rotary motor are rolled out flat to become the coil assembly (also sometimes called the slider).

In most brushless linear motor applications it is typical for the magnet way to be stationary and the coil assembly to be in motion, because of the relative masses of the two components. But it is also perfectly acceptable and sometimes advantageous to reverse this arrangement. The basic electromagnetic operating principles are the same in either case and are identical to those of a rotary motor.

► Direct Drive Linear (DDL) Motor

Direct Drive Linear Motor Options

Two types of linear motors are available, **Ironcore** and **Ironless**. Each one provides characteristics and features that are optimal depending upon the application. Ironcore motors have coils wound on silicon steel laminations, to maximize the generated force, with a single sided magnet way.

Using an electromagnetic design, Ironcore DDL linear motors have the highest rated force per size, a high Km motor constant (equals low thermal losses), and low cogging forces without the need for skewing of the magnets. The high thrust forces possible with these motors make them ideal for accelerating and moving high masses, and maintaining stiffness during machining or process forces.

Ironless motors have no iron, or slots for the coils to be wound on. Therefore, these motors have zero cogging, a very light mass, and absolutely no attractive forces between the coil assembly and the magnet way. These characteristics are ideal for applications requiring very low bearing friction, high acceleration of lighter loads, and for maximizing constant velocity, even at ultra low speeds. The modular magnet ways consists of a double row of magnets to maximize the generated thrust force and to provide a flux return path for the magnetic circuit.



Feedback Types

All brushless motors require feedback for commutation. The conventional rotary motor typically utilizes a resolver mounted on the rear of the motor or Hall effect devices mounted integrally in the coil windings. For a linear motor, commutation feedback can also be accomplished with a variety of methods. Digital or linear Hall effect devices are available from Kollmorgen for the DDL motor series which allow the drive electronics to commutate the linear motors in a manner identical to rotary motors.

For exceptionally smooth motion requirements, sinusoidal drive electronics such as the Kollmorgen's AKD® series, using digital Hall effects, provide sinusoidal drive currents to the motor for the best constant force and velocity performance. As an alternative, it is typical for linear motor applications to have a linear encoder present in the system for position feedback. It is increasingly common today for drive amplifiers, such as the AKD digital amplifier, to derive the necessary commutation information directly from this linear encoder, either with or without supplemental digital Hall effect devices on startup. Other types of feedback used on linear motor applications include linear Inductosyns, laser interferometers, and LVDT.

Advantages

Wide Speed Range

Since the frameless parts of the linear motor are non-contact, and no limitations of a mechanical transmission are present, both very high speeds and very low speeds are easily obtainable. Speeds are truly not limited by the motor. Instead, by eliminating the mechanical transmission, speed becomes limited by other elements in the system such as the linear bearings, and the achievable bandwidth from any feedback devices. Application speeds of greater than 5 meters per second (200 in./sec.) or less than 1 micron per second (.00004 in./sec.) are typically achievable. In comparison, mechanical transmissions such as ball screws are commonly limited to linear speeds of 0.5 to 0.7 meters per second (20-30 in./sec.) because of resonances and wear. In addition to a wide speed range, linear motors, both ironcore and ironless, have excellent constant velocity characteristics, typically better than $\pm 0.01\%$ speed variation.

High System Dynamics

In addition to high speed capability, direct drive linear motors are capable of very high accelerations. Limited only by the system bearings, accelerations of 3 to 5 G are quite typical for the larger motors and accelerations exceeding 10 G are easily achievable for smaller motors.

Easy Selection Process:

1. Determine peak and continuous force required for your applications (see the [Application Sizing](#) section) or use [MOTONEERING®](#), our online sizing and selection tool)
2. Use the [DDL Performance Summary](#) tables to choose your motor
3. Refer to the appropriate DDL performance data, performance curves, and dimensional drawings for technical details
4. Build a model number for ordering using the [Nomenclature](#) section

Smooth Operation and Positional Accuracy

Both ironless and ironcore motors exhibit very smooth motion profiles due to the inherent motor design of Kollmorgen's DDL series. Cogging, which is a component of force, is greatly reduced in the ironcore designs and is zero in the ironless designs. As a result, these direct drive linear motors provide very low force and velocity ripple for ultra smooth motion. Positioning accuracies are limited only by the feedback resolution, and sub-micron resolutions are commonly achievable.

Unlimited Travel

With the DDL motor series, magnet ways are made in 5 modular sections: 64 mm, 128 mm, 256 mm, and 512 mm long. Each module can be added in unlimited numbers to any other module to allow for unlimited travel. Whether the travel required is 1 mm (0.04 inches) or 100 meters (330 feet), the DDL series can accommodate the need.

No Wear or Maintenance

Linear motors have few components, therefore the need for ball screw components such as nuts, bearing blocks, couplings, motor mounts and the need to maintain these components have been eliminated. Very long life and clean operation, with no lubrication or maintenance of these parts are the result.

Integration of Components is Much Simpler

Frameless linear motors require much fewer components than rotary motors with mechanical transmissions. A 0.8 mm air gap (0.031 inches) for the ironcore design and 0.5 mm air gap (0.020 inches) for the ironless design is the only alignment of the frameless linear motor components that is necessary. No critical alignments are required as with ball screws. Straightness of travel as provided by the system linear bearings is more than sufficient for the Kollmorgen linear motors.

Typical Applications for Linear Motors Include:

Machine Tool	Carpet tufting
Drilling	Measurement/inspection
Milling	Coordinate measurement machines
Grinding	Electronic assembly
Laser cutting	Pick-and-place machines
Cam grinding	Component insertion
Semiconductor	Screen printers
Wafer handling process	Adhesive dispensers
Wafer-inspection	PC board inspection, drilling
Wafer slicing	
Tab bonding	
Wire bonding	
Ion implantation	
Lithography	
Battery stacking	
Battery welding	
Battery packaging	
Solar panel silk printing	
Textile	

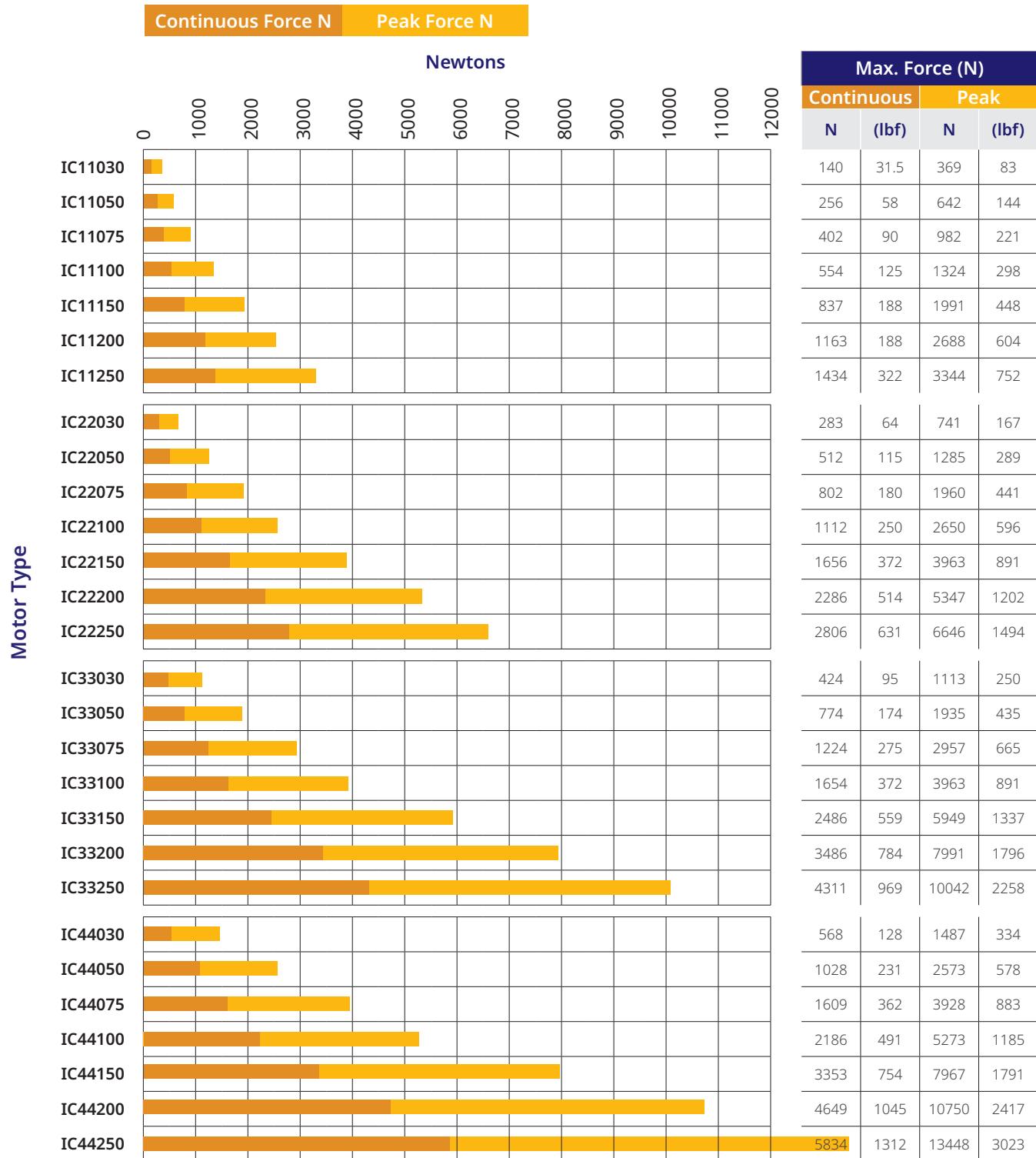
Other applications include:

Flight simulators
Acceleration sleds
G-Force measurement

Direct Drive Linear (DDL) Motor

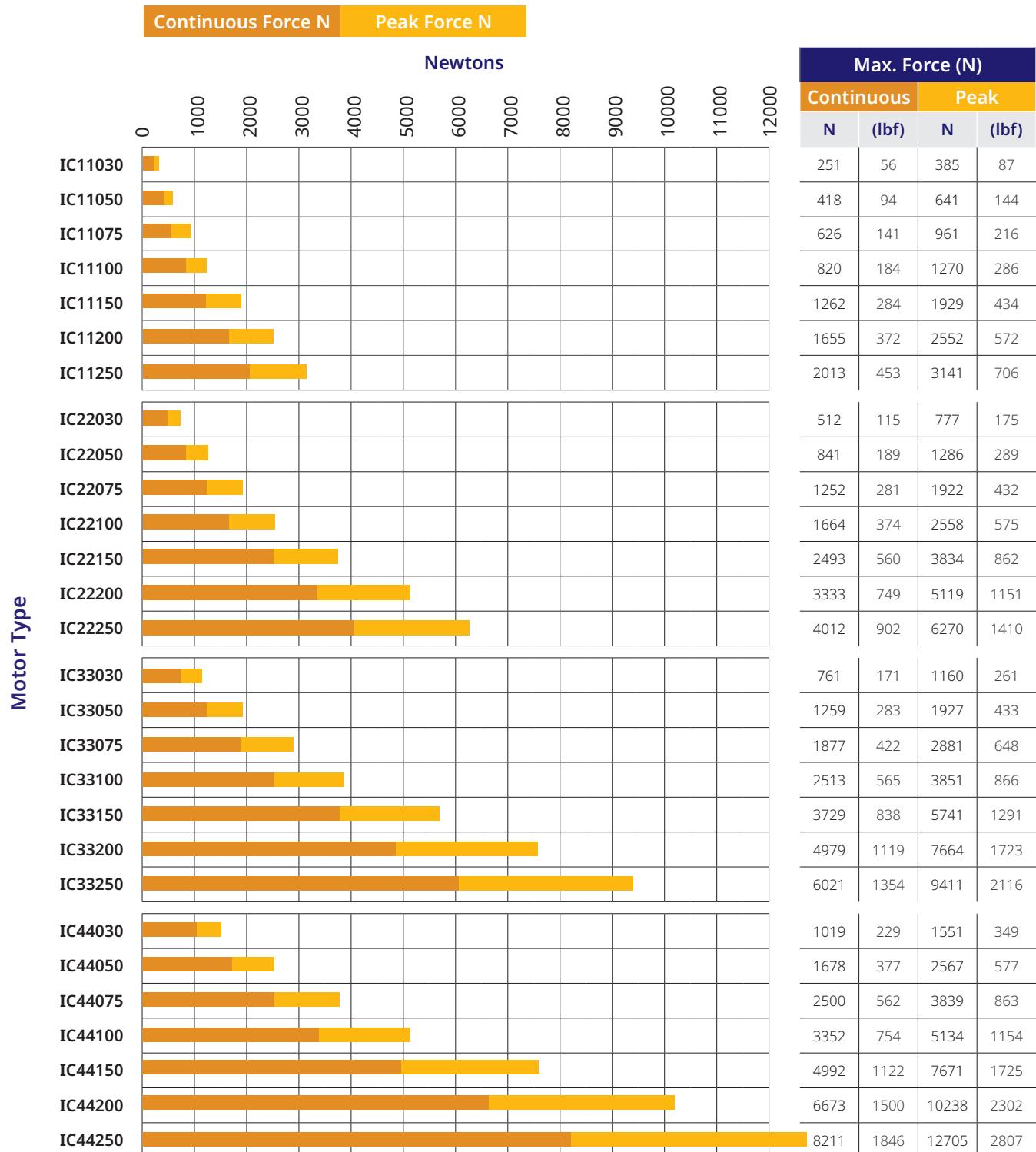
DDL Performance Summary

Ironcore Linear Motors – 230/400/480 Vac (Natural-Cooled)



Note: Performance data summarized here represents motor data only. For system performance data with Kollmorgen drives use the Motioneering Application Engine sizing software found here: <https://motiveering.kollmorgen.com>

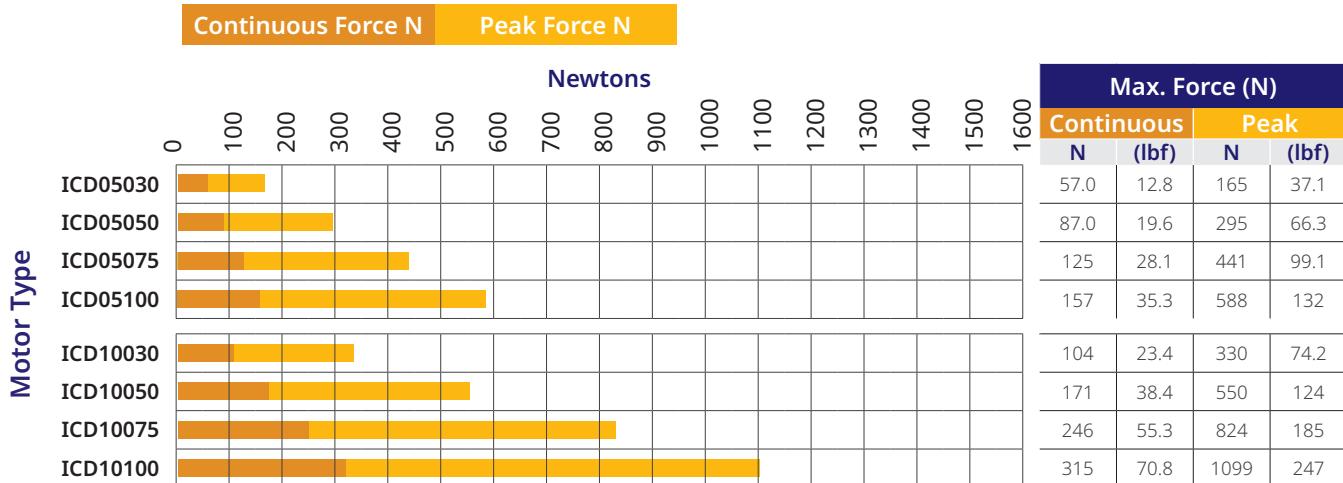
Ironcore Linear Motors - 230/400/480 Vac (Water-Cooled)



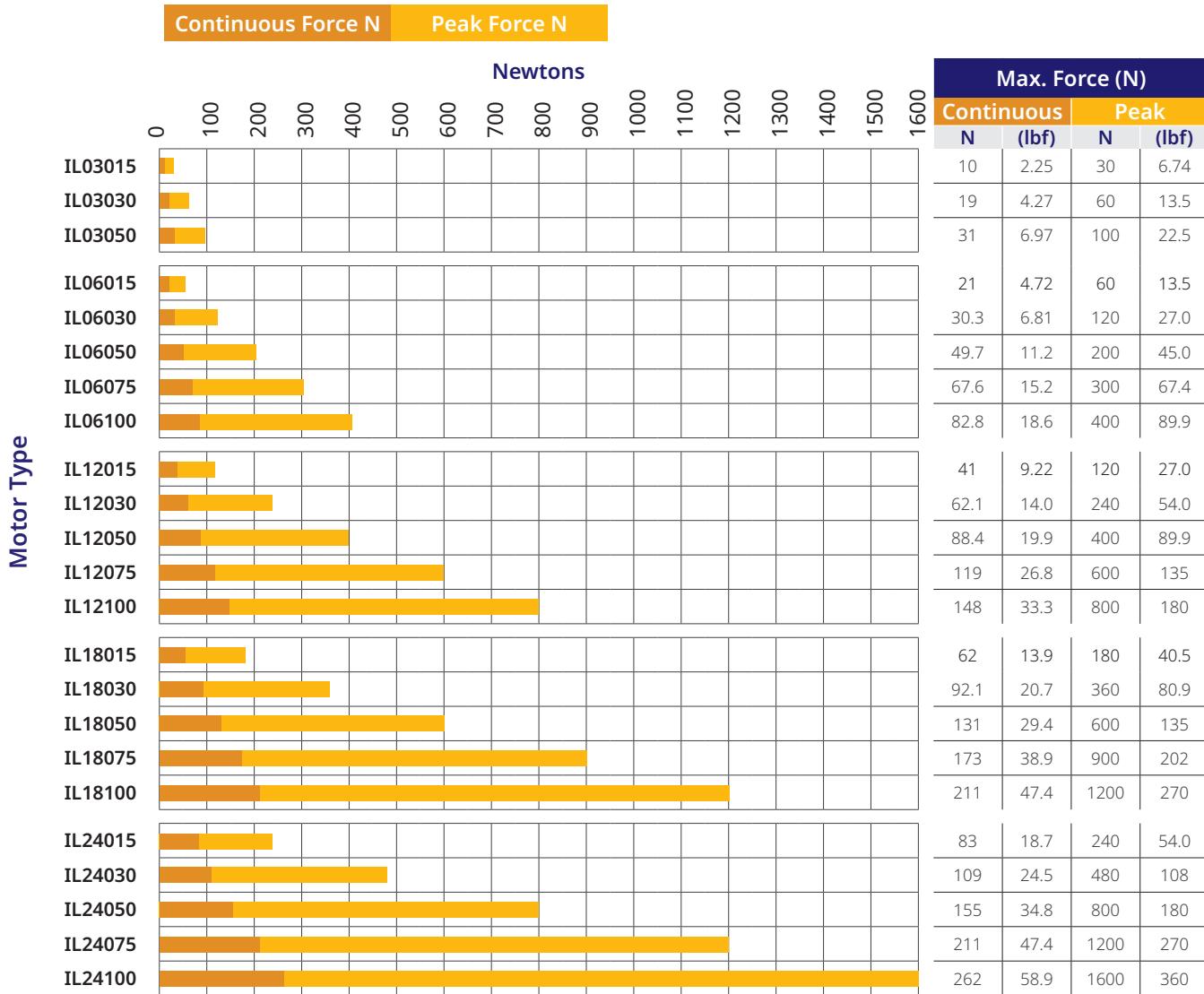
Note: Performance data summarized here represents motor data only. For system performance data with Kollmorgen drives use the Motioneering Application Engine sizing software found here: <https://motioneering.kollmorgen.com>

Direct Drive Linear (DDL) Motor

ICD Linear Motors 230 Vac



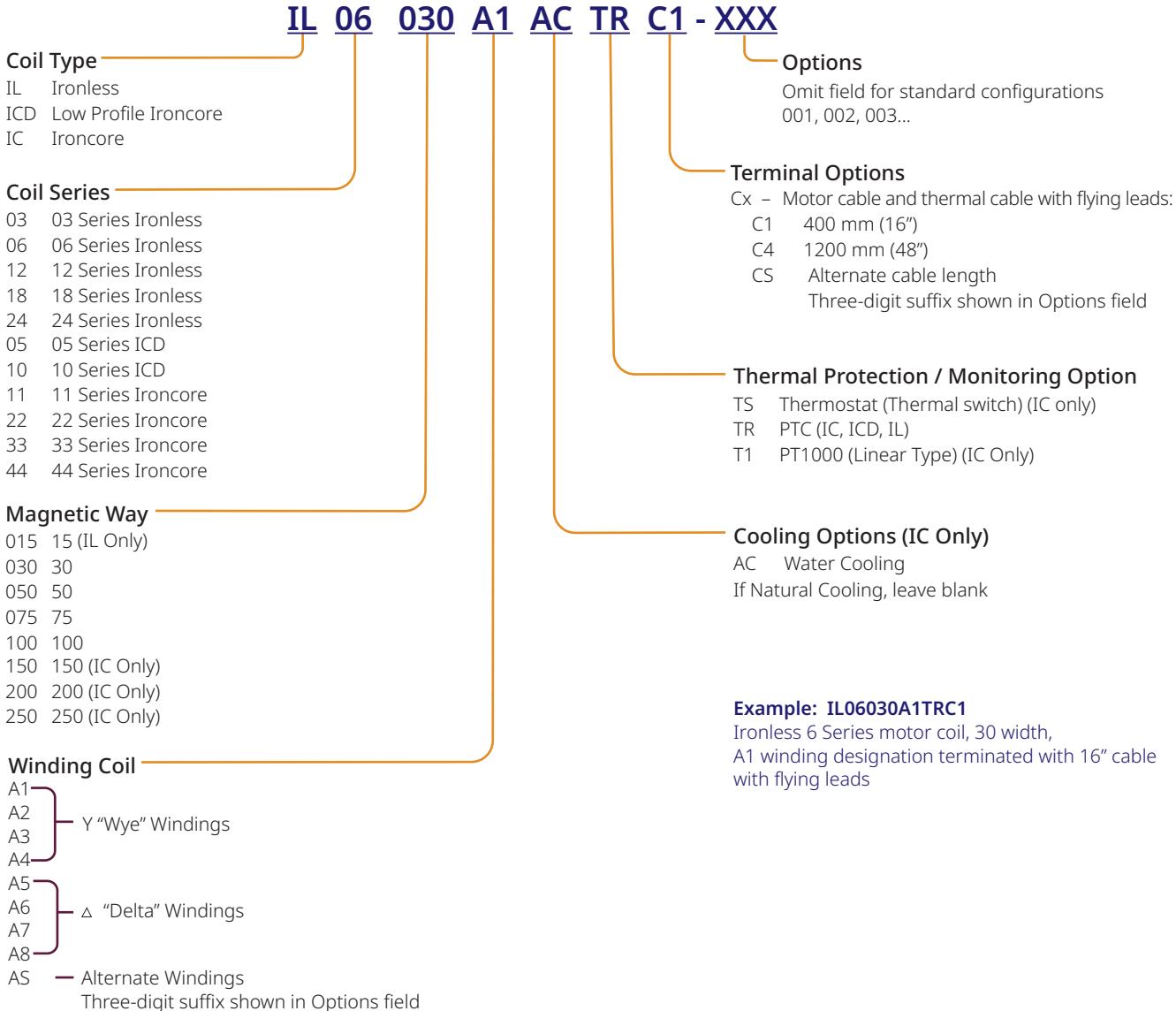
Ironless Linear Motors 230 Vac



Note: Performance data summarized here represents motor data only. For system performance data with Kollmorgen drives use the Motioneering Application Engine sizing software found here: <https://motiveering.kollmorgen.com>

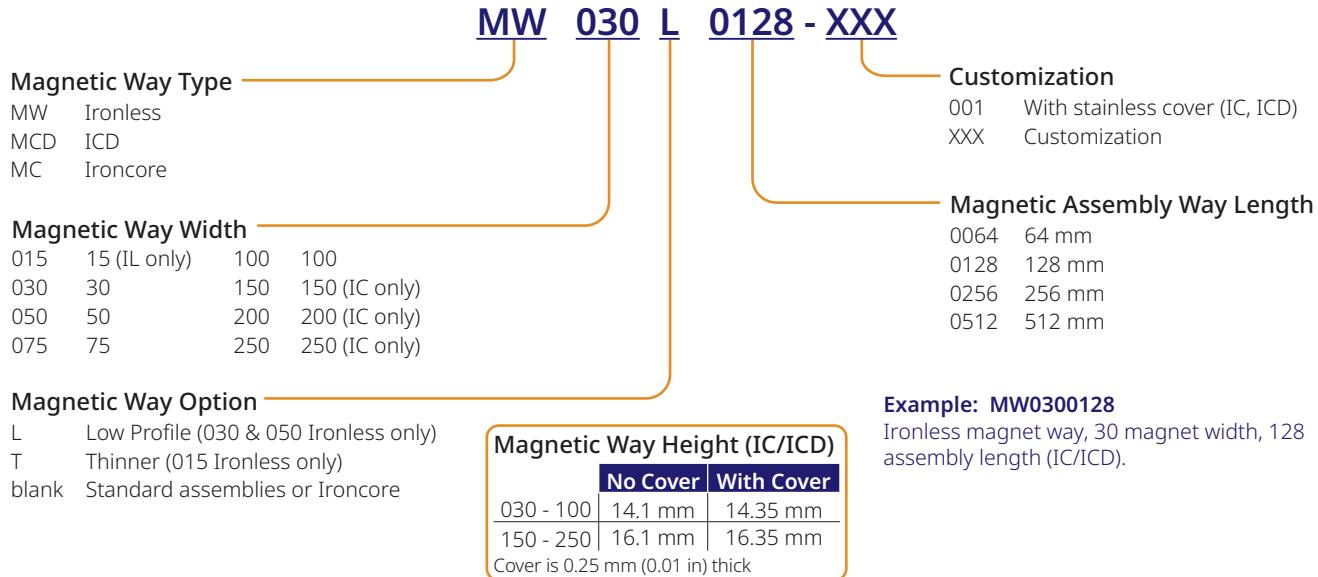
Model Nomenclature

Direct-Drive Linear Motor Coil Model Nomenclature

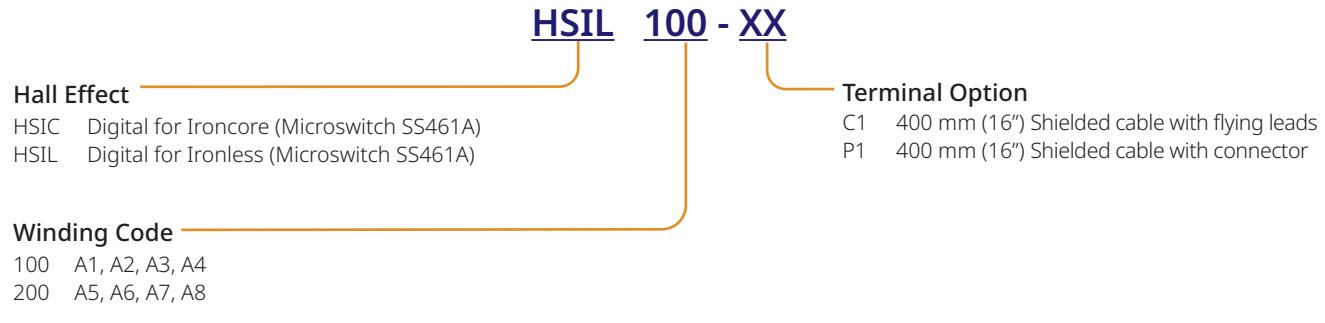


Model Nomenclature

Direct-Drive Linear Motor Magnetic Way Model Nomenclature



Direct-Drive Linear Motor Hall Effect Assembly Model Nomenclature



IC Ironcore DDL Motors

IC Ironcore Natural- and Water-cooled DDL Motors

Ironcore DDL linear motors have the highest rated force per size, a high Km motor constant (equals low thermal losses), and low cogging forces without the need for skewing of the magnets. The high thrust forces possible with these motors make them ideal for accelerating and moving high masses, and maintaining stiffness during machining or process forces.

General Specifications

- » Coil frame size 11, 22, 33, 44
- » Coil width 030, 050, 075, 100, 150, 200, 250
- » Low and high-speed coil winding designs fit various application needs
- » Water cooling increased continuous force output in the same profile
- » Low cogging electrical magnetic design for smooth force output

IC11/22/33/44

Peak force range	369 – 13448 N (83 - 3023 lbf)
Continuous force range	140 – 8211 N (31.5 - 1846 lbf)
Insulation voltage rating	230/400/480VAC
Cooling options	Natural-cooling and water-cooling
Feedback	Optional hall sensor
Thermal Devices	Thermostat Thermistor – PTC Thermistor – PT-1000
Certification	UL, CE, RoHS, REACH



IC11075



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IC Ironcore DDL Motors

IC11 Ironcore Natural-Cooled Motors Series Performance Data

Winding Code ②	Symbol	Tol	Units	IC11-030		IC11-050		IC11-075		IC11-100	
				A1	A5	A1	A5	A1	A5	A1	A5
Rated Performance											
Max Rated Voltage	Un		VAC	480	230	480	400	480	480	480	480
Max Continuous Force @ Tmax ① ⑤	Fc		N	140		256		402		554	
			lbf	31.5		58		90		125	
Motor constant	Km		N/VW	0.322		0.313		0.323		0.339	
Continous Current @ Tmax	Ic		Arms	3.97	6.9	4.35	7.5	4.56	7.9	4.71	8.2
Peak Force @ Tmax ⑤	Fp		N	369	369	641	642	982	980	1324	1323
			lbf	83	83	144	144	221	220	298	297
Peak Current @ Tmax ⑤	Ip		Arms	13.9	24.0	15.2	26.4	16.0	27.6	16.5	28.5
Rated force @ Speed ⑤	Frtd		N	129	112	246	230	394	380	547	534
			lbf	29	25.2	55	52	89	85	123	120
Rated Speed	Nrtd		m/s	8.4	13.5	4.86	8.7	3.15	5.7	2.25	4.14
Peak Force @ Tmax ⑤	Fp		N	369	-	641	642	982	980	1324	1323
			lbf	83	-	144	144	221	220	298	297
Peak Current @ Tmax ⑤	Ip		Arms	13.9	-	15.2	26.4	16.0	27.6	16.5	28.5
Rated force @ Speed ⑤	Frtd		N	112	-	229	189	380	336	534	496
			lbf	25.2	-	51	42.5	85	76	120	112
Rated Speed	Nrtd		m/s	13.5	-	8.8	13.5	5.8	10.3	4.23	7.6
Peak Force @ Tmax ⑤	Fp		N	369	-	641	-	982	980	1324	1323
			lbf	83	-	144	-	221	220	298	297
Peak Current @ Tmax ⑤	Ip		Arms	13.9	-	15.2	-	16.0	27.6	16.5	28.5
Rated force @ Speed ⑤	Frtd		N	109	-	217	-	370	302	526	470
			lbf	24.5	-	48.8	-	83	68	118	106
Rated Speed	Nrtd		m/s	13.5	-	10.7	-	6.9	12.5	5.1	9.2
Electrical Specifications ②											
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	1.95	0.66	2.68	0.9	3.6	1.21	4.51	1.51
Electrical Inductance L-L	L	±20%	mh	17.8	5.9	28.0	9.3	40.8	13.6	54	17.8
Force Constant @ 25°C	Kf	±10%	N/Arms	35.8	20.7	60	34.5	90	52	119	69
			lbf/Arms	8	4.65	13.5	7.8	20.2	11.7	26.8	15.5
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	29.3	16.9	48.8	28.2	73	42.2	98	56
			Vpeak/in/sec	0.74	0.43	1.24	0.72	1.86	1.07	2.48	1.43
Figures of Merit and Additional Data											
Electrical Time Constant	Te		ms	9.1		10.4		11.3		11.9	
Max. Theoretical Acceleration ③	Amax		g's	15.1		18.2		20.1		20.8	
Magnetic Attraction	Fa		kN	1.4		2.4		3.7		4.9	
			lbf	315		540		832		1102	
Thermal Resistance ④	Rthw-a		°C/Watt	1.64		0.99		0.67		0.5	
Max. Allowable Coil Temp. ④	Tmax		°C					130			
Mechanical Specifications											
Coil Assembly Weight	Mc	±15%	kg	2.5		3.6		5		6.5	
			lbs	5.5		7.9		11		14.3	
Magnet Way Type (MCxxx)				030		050		075		100	
Magnet Way Weight	Mw	±15%	kg/m	5.4		7.5		10.1		12.7	
			lbs/in	0.302		0.42		0.57		0.71	

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC11 Ironcore Natural-Cooled Motors Series Performance Data (Continued)

Winding Code ②	Symbol	Tol	Units	IC11-150		IC11-200		IC11-250					
				A1	A5	A1	A5	A1	A5				
Rated Performance													
Max Rated Voltage	Un		VAC	480	480	480	480	480	480				
Max Continuous Force @ Tmax ① ⑤	Fc		N	837		1163		1434					
			lbf	188		261		322					
Motor constant	Km		N/VW	0.383		0.42		0.46					
Continuous Current @ Tmax	Ic		Arms	4.74	8.2	4.9	8.6	4.87	8.5				
Peak Force @ Tmax ⑤	Fp		N	1990	1991	2687	2688	3336	3344				
			lbf	447	448	604	604	750	752				
Peak Current @ Tmax ⑤	Ip		Arms	16.6	28.8	17.3	30.0	16.9	29.5				
Rated force @ Speed ⑤	Frtd		N	832	820	1158	1150	1429	1421				
			lbf	187	184	260	259	321	319				
Rated Speed	Nrtd		m/s	1.35	2.70	0.99	1.89	0.72	1.44				
Peak Force @ Tmax ⑤	Fp		N	1990	1991	2687	2688	3348	3344				
			lbf	447	448	604	604	753	752				
Peak Current @ Tmax ⑤	Ip		Arms	16.6	28.8	17.3	30.0	17.1	29.5				
Rated force @ Speed ⑤	Frtd		N	820	789	1150	1121	1421	1398				
			lbf	184	177	259	252	319	314				
Rated Speed	Nrtd		m/s	2.70	4.95	1.89	3.60	1.44	2.79				
Peak Force @ Tmax ⑤	Fp		N	1990	1991	2687	2688	3348	3344				
			lbf	447	448	604	604	753	752				
Peak Current @ Tmax ⑤	Ip		Arms	16.6	28.8	17.3	30.0	17.1	29.5				
Rated force @ Speed ⑤	Frtd		N	813	768	1143	1103	1416	1381				
			lbf	183	173	257	248	318	310				
Rated Speed	Nrtd		m/s	3.33	6.0	2.34	4.41	1.80	3.42				
Electrical Specifications ②													
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	6.3	2.12	8.2	2.74	10.0	3.35				
Electrical Inductance L-L	L	±20%	mh	79	26.4	105	34.9	130	43.4				
Force Constant @ 25°C	Kf	±10%	N/Arms	179	103	239	138	299	172				
			lbf/Arms	40.2	23.2	54	31	67	38.7				
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	146	84	195	113	244	141				
			Vpeak/in/sec	3.71	2.14	4.95	2.86	6	3.57				
Figures of Merit and Additional Data													
Electrical Time Constant	Te		ms	12.5		12.8		13					
Max. Theoretical Acceleration ③	Amax		g's	21.6		22.3		22.5					
Magnetic Attraction	Fa		kN	7.3		9.9		12.3					
			lbf	1641		2226		2765					
Thermal Resistance ④	Rthw-a		°C/Watt	0.35		0.25		0.21					
Max. Allowable Coil Temp. ④	Tmax		°C	130									
Mechanical Specifications													
Coil Assembly Weight	Mc	±15%	kg	9.4		12.3		15.2					
			lbs	20.7		27.1		33.5					
Magnet Way Type (MCxxx)				150		200		250					
Magnet Way Weight	Mw	±15%	kg/m	20.7		26.8		33.2					
			lbs/in	1.16		1.5		1.86					

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC Ironcore DDL Motors

IC11 Ironcore Water-Cooled Motors Series Performance Data

Winding Code ②	Symbol	Tol	Units	IC11-030		IC11-050		IC11-075		IC11-100	
				A1	A5	A1	A5	A1	A5	A1	A5
Rated Performance											
Max Rated Voltage	Un		VAC	480	230	480	230	480	400	480	480
Max Continuous Force @ Tmax ① ⑤	Fc	N		251		418		626		820	
		lbf		56		94		141		184	
Motor constant	Km		N/VW	0.181		0.191		0.205		0.222	
Continous Current @ Tmax	Ic		Arms	9.8	17.0	9.8	17.1	9.8	17.0	9.6	16.6
Peak Force @ Tmax ⑤	Fp	N		384	385	641	641	961	960	1270	1270
		lbf		86	87	144	144	216	216	286	286
Peak Current @ Tmax ⑤	Ip		Arms	19.6	34.0	19.6	34.0	19.6	33.9	19.2	33.2
Rated force @ Speed ⑤	Frtd	N		241	230	410	395	619	606	814	802
		lbf		54	52	92	89	139	136	183	180
Rated Speed	Nrtd		m/s	9.2	13.5	5.3	9.9	3.4	6.5	2.43	4.77
Peak Force @ Tmax ⑤	Fp	N		384	-	641	-	961	960	1270	1270
		lbf		86	-	144	-	216	216	286	286
Peak Current @ Tmax ⑤	Ip		Arms	19.6	-	19.6	-	19.6	33.9	19.2	33.2
Rated force @ Speed ⑤	Frtd	N		230	-	395	-	606	565	802	766
		lbf		52	-	89	-	136	127	180	172
Rated Speed	Nrtd		m/s	13.5	-	10.0	-	6.5	11.9	4.77	8.8
Peak Force @ Tmax ⑤	Fp	N		384	-	641	-	961	-	1270	1270
		lbf		86	-	144	-	216	-	286	286
Peak Current @ Tmax ⑤	Ip		Arms	19.6	-	19.6	-	19.6	-	19.2	33.2
Rated force @ Speed ⑤	Frtd	N		228	-	384	-	597	-	795	742
		lbf		51	-	86	-	134	-	179	167
Rated Speed	Nrtd		m/s	13.5	-	12.2	-	7.9	-	5.6	10.7
Electrical Specifications ②											
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	1.58	0.53	2.17	0.73	2.90	0.97	3.64	1.22
Electrical Inductance L-L	L	±20%	mh	11.4	3.80	18.0	6.0	26.2	8.7	34.4	11.5
Force Constant @ 25°C	Kf	±10%	N/Arms	28.7	16.6	47.8	27.6	72	41.4	96	55
			lbf/Arms	6.5	3.73	10.7	6.2	16.2	9.3	21.6	12.4
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	23.4	13.5	39.1	22.6	59	33.8	78	45.1
			Vpeak/in/sec	0.6	0.344	0.99	0.57	1.49	0.86	1.98	1.15
Figures of Merit and Additional Data											
Electrical Time Constant	Te		ms	7.2		8.3		9.0		9.5	
Max. Theoretical Acceleration ③	Amax		g's	15.8		18.2		19.6		20.0	
Magnetic Attraction	Fa		kN	1.4		2.4		3.7		4.9	
			lbf	315		540		832		1102	
Thermal Resistance ④	Rthw-a		°C/Watt	0.33		0.24		0.18		0.15	
Max. Allowable Coil Temp. ④	Tmax		°C			130					
Min. Flow Rate of Coolant @ 25°C Max.			liters/min			2.8					
Mechanical Specifications											
Coil Assembly Weight	Mc	±15%	kg	2.5		3.6		5		6.5	
			lbs	5.5		7.9		11		14.3	
Magnet Way Type (MCxxx)				030		050		075		100	
Magnet Way Weight	Mw	±15%	kg/m	5.4		7.5		10.1		12.7	
			lbs/in	0.302		0.42		0.57		0.71	

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.

② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

⑤ All data referenced to sinusoidal commutation

IC11 Ironcore Water-Cooled Motors Series Performance Data (Continued)

Winding Code ②	Symbol	Tol	Units	IC11-150		IC11-200		IC11-250	
				A1	A5	A1	A5	A1	A5
Rated Performance									
Max Rated Voltage	Un		VAC	480	480	480	480	480	480
Max Continuous Force @ Tmax ① ⑤	Fc		N	1262		1655		2013	
			lbf	284		372		453	
Motor constant	Km		N/W	0.249		0.281		0.308	
Continuous Current @ Tmax	Ic		Arms	9.9	17.1	9.7	16.8	9.4	16.2
Peak Force @ Tmax ⑤	Fp		N	1929	1929	2552	2552	3141	3141
			lbf	434	434	574	574	706	706
Peak Current @ Tmax ⑤	Ip		Arms	19.8	34.3	19.4	33.6	18.7	32.4
Rated force @ Speed ⑤	Frtd		N	1257	1247	1651	1643	2010	2002
			lbf	283	280	371	369	452	450
Rated Speed	Nrtd		m/s	1.44	2.97	0.99	2.07	0.63	1.62
Peak Force @ Tmax ⑤	Fp		N	1929	1929	2552	2552	3140	3141
			lbf	434	434	574	574	706	706
Peak Current @ Tmax ⑤	Ip		Arms	19.8	34.3	19.4	33.6	18.7	32.4
Rated force @ Speed ⑤	Frtd		N	1247	1220	1643	1617	2002	1979
			lbf	280	274	369	364	450	445
Rated Speed	Nrtd		m/s	2.97	5.6	2.07	4.14	1.62	3.24
Peak Force @ Tmax ⑤	Fp		N	1929	1929	2552	2552	3141	3141
			lbf	434	434	574	574	706	706
Peak Current @ Tmax ⑤	Ip		Arms	19.8	34.3	19.4	33.6	18.7	32.4
Rated force @ Speed ⑤	Frtd		N	1241	1201	1637	1601	1997	1964
			lbf	279	270	368	360	449	442
Rated Speed	Nrtd		m/s	3.69	6.8	2.61	5.0	2.07	3.96
Electrical Specifications ②									
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	5.1	1.70	6.6	2.19	8.0	2.68
Electrical Inductance L-L	L	±20%	mh	51	16.9	67	22.4	84	27.9
Force Constant @ 25°C	Kf	±10%	N/Arms	144	83	191	110	239	138
			lbf/Arms	32.4	18.7	42.9	24.7	54	31
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	117	68	156	90	195	113
			Vpeak/in/sec	2.98	1.72	3.97	2.29	4.96	2.86
Figures of Merit and Additional Data									
Electrical Time Constant	Te		ms	10.0		10.2		10.5	
Max. Theoretical Acceleration ③	Amax		g's	21.0		21.2		21.1	
Magnetic Attraction	Fa		kN	7.3		9.9		12.3	
			lbf	1641		2226		2765	
Thermal Resistance ④	Rthw-a		°C/Watt	0.10		0.08		0.07	
Max. Allowable Coil Temp. ④	Tmax		°C			130			
Min. Flow Rate of Coolant @ 25°C Max.			liters/min			2.8			
Mechanical Specifications									
Coil Assembly Weight	Mc	±15%	kg	9.4		12.3		15.2	
			lbs	20.7		27.1		33.5	
Magnet Way Type (MCxxx)				150		200		250	
Magnet Way Weight	Mw	±15%	kg/m	20.7		26.8		33.2	
			lbs/in	1.16		1.5		1.86	

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.

② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

⑤ All data referenced to sinusoidal commutation

IC Ironcore DDL Motors

IC22 Ironcore Natural-Cooled Motors Series Performance Data

Winding Code ②	Symbol	Tol	Units	IC22-030			IC22-050			IC22-075			IC22-100		
				A1	A2	A6	A1	A2	A6	A1	A2	A6	A1	A2	A6
Rated Performance															
Max Rated Voltage	Un		VAC	480	480	230	480	480	230	480	480	230	480	480	400
Max Continuous Force @ Tmax ① ⑤	Fc		N	283			512			802			1112		
			Ibf	64			115			180			250		
Motor constant	Km		N/VW	0.41			0.41			0.44			0.46		
Continous Current @ Tmax	Ic		Arms	4.00	8.0	13.9	4.35	8.7	15.1	4.55	9.1	15.8	4.73	9.5	16.4
Peak Force @ Tmax ⑤	Fp		N	741	741	741	1283	1285	1284	1959	1959	1960	2648	2650	2516
			Ibf	167	167	167	288	289	289	440	440	441	595	596	566
Peak Current @ Tmax ⑤	Ip		Arms	14.0	28.0	48.5	15.2	30.5	53	15.9	31.8	55	16.5	33.1	50
Rated force @ Speed ⑤	Frtd		N	276	261	227	507	494	460	798	786	758	1108	1098	1073
			Ibf	62	59	51	114	111	103	179	177	170	249	247	241
Rated Speed	Nrtd		m/s	3.96	8.4	13.5	2.25	4.90	8.7	1.35	3.15	5.7	0.90	2.25	4.14
Peak Force @ Tmax ⑤	Fp		N	741	741	-	1283	1285	-	1959	1959	-	2648	2650	2516
			Ibf	167	167	-	288	289	-	440	440	-	595	596	566
Peak Current @ Tmax ⑤	Ip		Arms	14.0	28.0	-	15.2	30.5	-	15.9	31.8	-	16.5	33.1	50
Rated force @ Speed ⑤	Frtd		N	265	227	-	498	459	-	789	757	-	1102	1073	997
			Ibf	60	51	-	112	103	-	177	170	-	248	241	224
Rated Speed	Nrtd		m/s	7.2	13.5	-	4.14	8.8	-	2.70	5.8	-	1.89	4.14	7.6
Peak Force @ Tmax ⑤	Fp		N	741	741	-	1283	1285	-	1959	1959	-	2648	2650	-
			Ibf	167	167	-	288	289	-	440	440	-	595	596	-
Peak Current @ Tmax ⑤	Ip		Arms	14.0	28.0	-	15.2	30.5	-	15.9	31.8	-	16.5	33.1	-
Rated force @ Speed ⑤	Frtd		N	259	221	-	492	435	-	785	739	-	1097	1055	-
			Ibf	58	49.7	-	111	98	-	176	166	-	247	237	-
Rated Speed	Nrtd		m/s	8.7	13.5	-	5.1	10.7	-	3.24	6.9	-	2.34	5.1	-
Electrical Specifications ②															
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	3.81	0.96	0.324	5.3	1.33	0.45	7.1	1.79	0.60	8.9	2.25	0.75
Electrical Inductance L-L	L	±20%	mh	35.5	8.9	2.96	56	14.0	4.66	82	20.4	6.8	107	26.8	8.9
Force Constant @ 25°C	Kf	±10%	N/Arms	72	35.8	20.7	119	60	34.5	179	90	52	239	119	69
			Ibf/Arms	16.2	8	4.65	26.8	13.5	7.8	40.2	20.2	11.7	54	26.8	15.5
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	59	29.3	16.9	98	48.8	28.2	146	73	42.2	195	98	56
			Vpeak/in/sec	1.49	0.74	0.43	2.48	1.24	0.72	3.71	1.86	1.07	4.95	2.48	1.43
Figures of Merit and Additional Data															
Electrical Time Constant	Te		ms	9.3			10.6			11.5			12		
Max. Theoretical Acceleration ③	Amax		g's	15.8			19.0			20.8			21.6		
Magnetic Attraction	Fa		kN	2.9			4.9			7.3			9.8		
			Ibf	652			1102			1641			2203		
Thermal Resistance ④	Rthw-a		°C/Watt	0.82			0.50			0.34			0.25		
Max. Allowable Coil Temp. ④	Tmax		°C							130					
Mechanical Specifications															
Coil Assembly Weight	Mc	±15%	kg	4.8			6.9			9.6			12.5		
			lbs	10.6			15.2			21.2			27.6		
Magnet Way Type (MCxxx)				030			050			075			100		
Magnet Way Weight	Mw	±15%	kg/m	5.4			7.5			10.1			12.7		
			lbs/in	0.302			0.42			0.57			0.71		

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC22 Ironcore Natural-Cooled Motors Series Performance Data (Continued)

	Symbol	Tol	Units	IC22-150			IC22-200			IC22-250		
				A1	A2	A6	A1	A2	A6	A1	A2	A6
Winding Code ②												
Rated Performance												
Max Rated Voltage	Un		VAC	480	480	480	480	480	480	480	480	480
Max Continuous Force @ Tmax ① ⑤	Fc	N		1656			2286			2806		
		lbf		372			514			631		
Motor constant	Km		N/lW	0.54			0.59			0.65		
Continous Current @ Tmax	Ic		Arms	4.69	9.4	16.3	4.86	9.7	16.8	4.77	9.5	16.5
230 VAC	Fp	N		3628	3963	3428	4151	5347	4570	4494	6646	5713
		lbf		816	891	771	933	1202	1027	1010	1494	1284
Peak Force @ Tmax ⑤												
Peak Current @ Tmax ⑤	Ip		Arms	13.4	32.8	42.0	10.4	34.0	42.0	8.5	33.4	42.0
400 VAC	Frtd	N		1653	1643	1622	2285	2277	2259	2805	2797	2782
		lbf		372	369	365	514	512	508	631	629	625
Rated Speed	Nrtd		m/s	0.54	1.44	2.70	0.27	0.99	1.89	0.18	0.72	1.44
480 VAC	Fp	N		3963	3963	3428	5347	5347	4570	6333	6646	5713
		lbf		891	891	771	1202	1202	1027	1424	1494	1284
Peak Current @ Tmax ⑤	Ip		Arms	16.4	32.8	42.0	17.0	34.0	42.0	14.8	33.4	42.0
480 VAC	Frtd	N		1647	1621	1559	2278	2259	2202	2801	2780	2735
		lbf		370	364	350	512	508	495	630	625	615
Rated Speed	Nrtd		m/s	1.17	2.70	4.95	0.81	1.89	3.60	0.54	1.53	2.79
Electrical Specifications ②												
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	12.6	3.16	1.06	16.3	4.08	1.36	19.9	5.0	1.67
Electrical Inductance L-L	L	±20%	mh	158	39.6	13.2	209	52	17.4	260	65	21.7
Force Constant @ 25°C	Kf	±10%	N/Arms	358	179	103	478	239	138	597	299	172
			lbf/Arms	80	40.2	23.2	107	54	31	134	67	38.7
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	293	146	84	390	195	113	488	244	141
			Vpeak/in/sec	7	3.71	2.14	10	4.95	2.86	12	6	3.57
Figures of Merit and Additional Data												
Electrical Time Constant	Te		ms	12.5			12.8			13.1		
Max. Theoretical Acceleration ③	Amax		g's	22.3			23.1			23.0		
Magnetic Attraction	Fa		kN	14.6			19.7			24.6		
			lbf	3282			4429			5530		
Thermal Resistance ④	Rthw-a		°C/Watt	0.18			0.13			0.11		
Max. Allowable Coil Temp. ④	Tmax		°C	130								
Mechanical Specifications												
Coil Assembly Weight	Mc	±15%	kg	18.1			23.7			29.3		
			lbs	39.9			52			65		
Magnet Way Type (MCxxx)												
Magnet Way Weight	Mw	±15%	kg/m	150			200			250		
			lbs/in	20.7			26.8			33.2		
				1.16			1.5			1.86		

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
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- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC Ironcore DDL Motors

IC22 Ironcore Water-Cooled Motors Series Performance Data

Winding Code ②	Symbol	Tol	Units	IC22-030			IC22-050			IC22-075			IC22-100							
				A1	A2	A6	A1	A2	A6	A1	A2	A6	A1	A2	A6					
Rated Performance																				
Max Rated Voltage	Un		VAC	480	230	230	480	480	230	480	480	230	480	480	230					
Max Continuous Force @ Tmax ① ⑤	Fc		N	512			841			1252			1664							
			lbf	115			189			281			374							
Motor constant	Km		N/VW	0.239			0.256			0.279			0.305							
Continous Current @ Tmax	Ic		Arms	10.1	20.2	34.9	9.9	19.8	34.3	9.8	19.6	33.9	9.8	19.5	33.8					
Peak Force @ Tmax ⑤	Fp		N	777	777	777	1286	1286	1286	1922	1922	1922	2557	2557	2558					
			lbf	175	175	175	289	289	289	432	432	432	575	575	575					
Peak Current @Tmax ⑤	Ip		Arms	20.2	40.3	70	19.8	39.6	67	19.6	39.2	68	19.5	39.0	68					
Rated force @ Speed ⑤	Frtd		N	507	494	471	837	825	795	1248	1238	1213	1661	1652	1629					
			lbf	114	111	106	188	185	179	281	278	273	373	371	366					
Rated Speed	Nrtd		m/s	4.05	9.1	13.5	2.34	5.3	9.9	1.35	3.42	6.4	0.90	2.43	4.68					
Peak Force @ Tmax ⑤	Fp		N	777	-	-	1286	1286	-	1922	1922	-	2557	2557	-					
			lbf	175	-	-	289	289	-	432	432	-	575	575	-					
Peak Current @ Tmax ⑤	Ip		Arms	20.2	-	-	19.8	39.6	-	19.6	39.2	-	19.5	39.0	-					
Rated force @ Speed ⑤	Frtd		N	498	-	-	829	795	-	1241	1212	-	1655	1629	-					
			lbf	112	-	-	186	179	-	279	272	-	372	366	-					
Rated Speed	Nrtd		m/s	7.7	-	-	4.50	9.9	-	2.88	6.5	-	2.07	4.68	-					
400 VAC	Fp		N	777	-	-	1286	1286	-	1922	1922	-	2557	2557	-					
			lbf	175	-	-	289	289	-	432	432	-	575	575	-					
Peak Current @ Tmax ⑤	Ip		Arms	20.2	-	-	19.8	39.6	-	19.6	39.2	-	19.5	39.0	-					
Rated force @ Speed ⑤	Frtd		N	498	-	-	829	795	-	1241	1212	-	1655	1629	-					
			lbf	112	-	-	186	179	-	279	272	-	372	366	-					
Rated Speed	Nrtd		m/s	7.7	-	-	4.50	9.9	-	2.88	6.5	-	2.07	4.68	-					
Electrical Specifications ②																				
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	3.08	0.77	0.260	4.26	1.07	0.358	5.7	1.43	0.48	7.2	1.80	0.60					
Electrical Inductance L-L	L	±20%	mh	22.8	5.7	1.90	35.9	9.0	2.99	52	13.1	4.36	69	17.2	5.7					
Force Constant @ 25°C	Kf	±10%	N/Arms	57	28.7	16.6	96	47.8	27.6	144	72	41.4	191	96	55					
			lbf/Arms	12.8	6.5	3.73	21.6	10.7	6.2	32.4	16.2	9.3	42.9	21.6	12.4					
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	46.9	23.4	13.5	78.1	39.1	22.6	117	59	33.8	156	78	45.1					
			Vpeak/in/sec	1.19	0.6	0.344	1.98	0.99	0.57	2.98	1.49	0.86	3.97	1.98	1.15					
Figures of Merit and Additional Data																				
Electrical Time Constant	Te		ms	7.4			8.4			9.1			9.6							
Max. Theoretical Acceleration ③	Amax		g's	16.5			19.0			20.4			20.8							
Magnetic Attraction	Fa		kN	2.9			4.9			7.3			9.8							
			lbf	652			1102			1641			2203							
Thermal Resistance ④	Rthw-a		°C/Watt	0.16			0.12			0.091			0.073							
Max. Allowable Coil Temp. ④	Tmax		°C	130																
Min. Flow Rate of Coolant @ 25°C Max.			liters/min	2.8																
Mechanical Specifications																				
Coil Assembly Weight	Mc	±15%	kg	4.8			6.9			9.6			12.5							
Magnet Way Type (MCxxx)																				
Magnet Way Weight	Mw	±15%	kg/m	5.4			7.5			10.1			12.7							
			lbs/in	0.302			0.42			0.57			0.71							

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC22 Ironcore Water-Cooled Motors Series Performance Data (Continued)

Winding Code ②	Symbol	Tol	Units	IC22-150			IC22-200			IC22-250		
				A1	A2	A6	A1	A2	A6	A1	A2	A6
Rated Performance												
Max Rated Voltage	Un		VAC	480	480	230	480	480	230	480	480	230
Max Continuous Force @ Tmax ① ⑤	Fc	N		2493			3333			4012		
		lbf		560			749			902		
Motor constant	Km		N·V/W	0.349			0.391			0.44		
Continuous Current @ Tmax	Ic		Arms	9.7	19.5	33.7	9.8	19.6	33.9	9.3	18.6	32.2
230 VAC	Fp	N		3570	3832	3834	4084	5119	5118	-	6267	6270
		lbf		803	861	862	918	1151	1151	-	1409	1410
Peak Current @ Tmax ⑤	Ip		Arms	16.7	38.9	68	13.0	39.1	68	-	37.2	65
400 VAC	Frtd	N		2491	2483	2464	3332	3325	3309	-	4006	3989
		lbf		560	558	554	749	747	744	-	901	897
Rated Speed	Nrtd	m/s		0.36	1.44	2.97	0.13	0.99	2.07	-	0.63	1.62
480 VAC	Fp	N		3535	3832	-	5114	5119	-	6236	6267	-
		lbf		795	861	-	1150	1151	-	1402	1409	-
Peak Current @ Tmax ⑤	Ip		Arms	19.5	38.9	-	19.5	39.1	-	18.6	37.2	-
480 VAC	Frtd	N		2486	2464	-	3327	3309	-	4008	3988	-
		lbf		559	554	-	748	744	-	901	897	-
Rated Speed	Nrtd	m/s		1.17	2.97	-	0.72	2.07	-	0.45	1.62	-
Electrical Specifications ②												
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	10.1	2.54	0.85	13.1	3.27	1.09	16.0	4.00	1.34
Electrical Inductance L-L	L	±20%	mh	102	25.4	8.5	134	33.6	11.2	167	41.8	13.9
Force Constant @ 25°C	Kf	±10%	N/Arms	287	144	83	383	191	110	478	239	138
			lbf/Arms	65	32.4	18.7	86	42.9	24.7	107	54	31
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	234	117	68	313	156	90	391	195	113
			Vpeak/in/sec	6	2.98	1.72	8	3.97	2.29	10	4.96	2.86
Figures of Merit and Additional Data												
Electrical Time Constant	Te		ms	10.1			10.2			10.4		
Max. Theoretical Acceleration ③	Amax		g's	21.6			22.1			21.7		
Magnetic Attraction	Fa		kN	14.6			19.7			24.6		
			lbf	3282			4429			5530		
Thermal Resistance ④	Rthw-a		°C/Watt	0.052			0.040			0.036		
Max. Allowable Coil Temp. ④	Tmax		°C	130								
Min. Flow Rate of Coolant @ 25°C Max.			liters/min	2.8								
Mechanical Specifications												
Coil Assembly Weight	Mc	±15%	kg	18.1			23.7			29.3		
			lbs	39.9			52			65		
Magnet Way Type (MCxxx)				150			200			250		
Magnet Way Weight	Mw	±15%	kg/m	20.7			26.8			33.2		
			lbs/in	1.16			1.5			1.86		

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC Ironcore DDL Motors

IC33 Ironcore Natural-Cooled Motors Series Performance Data

Winding Code ②	Symbol	Tol	Units	IC33-030				IC33-050				IC33-075				IC33-100			
				A1	A3	A5	A7	A1	A3	A5	A7	A1	A3	A5	A7	A1	A3	A5	A7
Rated Performance																			
Max Rated Voltage	Un		VAC	480	400	480	230	480	400	480	230	480	400	480	230	480	400	480	230
Max Continuous Force @ Tmax ① ⑤	Fc		N		424				774				1224				1654		
Motor constant	Km		N/√W		0.49				0.49				0.52				0.57		
Continous Current @ Tmax	Ic		Arms	4.00	12.0	6.9	20.8	4.39	13.2	7.6	22.8	4.62	13.9	8.0	24.0	4.69	14.1	8.1	24.4
Peak Force @ Tmax ⑤	Fp		N	1112	1112	1113	1112	1935	1933	1932	1896	2957	2957	2844	3536	3963	3963	3793	
			lbf	250	250	250	250	435	435	434	426	665	665	639	795	891	891	853	
Peak Current @ Tmax ⑤	Ip		Arms	14.0	42.0	24.3	73	15.4	46.1	26.6	76	16.2	48.5	28.0	76	12.8	49.2	28.4	76
Rated force @ Speed ⑤	Frtd		N	419	391	411	339	770	746	763	695	1220	1199	1215	1157	1652	1633	1646	1595
			lbf	94	88	92	76	173	168	172	156	274	270	273	260	371	367	370	359
Rated Speed	Nrtd		m/s	2.52	8.4	4.68	13.5	1.35	4.86	2.61	8.7	0.81	3.15	1.62	5.7	0.45	2.25	1.17	4.14
Peak Force @ Tmax ⑤	Fp		N	1112	1112	1113	-	1935	1933	1932	-	2959	2957	2957	-	3963	3963	3963	-
			lbf	250	250	250	-	435	435	434	-	665	665	665	-	891	891	891	-
Peak Current @ Tmax ⑤	Ip		Arms	14.0	42.0	24.3	-	15.4	46.1	26.6	-	16.2	48.5	28.0	-	16.4	49.2	28.4	-
Rated force @ Speed ⑤	Frtd		N	411	339	390	-	763	693	746	-	1215	1155	1199	-	1646	1593	1633	-
			lbf	92	76	88	-	172	156	168	-	273	260	270	-	370	358	367	-
Rated Speed	Nrtd		m/s	4.68	13.5	8.5	-	2.61	8.8	4.86	-	1.62	5.8	3.15	-	1.17	4.23	2.25	-
400 VAC	Fp		N	1112	1112	1113	-	1935	1933	1932	-	2959	2957	2957	-	3963	3963	3963	-
			lbf	250	250	250	-	435	435	434	-	665	665	665	-	891	891	891	-
Peak Current @ Tmax ⑤	Ip		Arms	14.0	42.0	24.3	-	15.4	46.1	26.6	-	16.2	48.5	28.0	-	16.4	49.2	28.4	-
Rated force @ Speed ⑤	Frtd		N	411	339	390	-	763	693	746	-	1215	1155	1199	-	1646	1593	1633	-
			lbf	92	76	88	-	172	156	168	-	273	260	270	-	370	358	367	-
Rated Speed	Nrtd		m/s	4.68	13.5	8.5	-	2.61	8.8	4.86	-	1.62	5.8	3.15	-	1.17	4.23	2.25	-
Electrical Specifications ②																			
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	5.7	0.64	1.90	0.213	7.9	0.88	2.63	0.294	10.6	1.19	3.55	0.396	13.4	1.49	4.47	0.50
Electrical Inductance L-L	L	±20%	mh	52	5.8	17.4	1.93	82.1	9.1	27.4	3.04	120	13.3	39.9	4.43	157	17.4	52	5.8
Force Constant @ 25°C	Kf	±10%	N/Arms	107	35.8	62	20.7	179	60	103	34.5	269	90	155	52	358	119	207	69
			lbf/Arms	24.1	8	13.9	4.65	40.2	13.5	23.2	7.8	60	20.2	34.8	11.7	80	26.8	46.5	15.5
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	88	29.3	51	16.9	146	48.8	84	28.2	219	73	127	42.2	293	98	169	56
			Vpeak/in/sec	2.23	0.74	1.29	0.43	3.71	1.24	2.14	0.72	6	1.86	3.22	1.07	7	2.48	4.29	1.43
Figures of Merit and Additional Data																			
Electrical Time Constant	Te		ms		9.1				10.4				11.3				11.7		
Max. Theoretical Acceleration ③	Amax		g's		15.5				19.0				21.0				21.4		
Magnetic Attraction	Fa		kN		4.4				7.4				11.0				14.7		
			lbf		989				1664				2473				3305		
Thermal Resistance ④	Rthw-a		°C/Watt		0.55				0.33				0.22				0.17		
Max. Allowable Coil Temp. ④	Tmax		°C									130							
Mechanical Specifications																			
Coil Assembly Weight	Mc	±15%	kg		7.3				10.4				14.4				18.9		
			lbs		16.1				22.9				31.7				41.7		
Magnet Way Type (MCxxx)																			
Magnet Way Weight	Mw	±15%	kg/m		5.4				7.5				10.1				12.7		
			lbs/in		0.302				0.42				0.57				0.71		

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC33 Ironcore Natural-Cooled Motors Series Performance Data (Continued)

Winding Code ②	Symbol	Tol	Units	IC33-150				IC33-200				IC33-250			
				A1	A3	A5	A7	A1	A3	A5	A7	A1	A3	A5	A7
Rated Performance															
Max Rated Voltage	Un		VAC	480	400	480	230	480	400	480	230	480	400	480	230
Max Continuous Force @ Tmax ① ⑤	Fc		N	2486				3486				4311			
			lbf	559				784				969			
Motor constant	Km		N·V/W	0.65				0.71				0.78			
Continous Current @ Tmax	Ic		Arms	4.70	14.1	8.1	24.4	4.90	14.8	8.6	25.7	4.89	14.7	8.5	25.4
230 VAC	Peak Force @ Tmax ⑤	Fp	N	4235	5949	5837	5689	4640	7991	6840	7585	4904	9988	7498	9482
			lbf	952	1337	1312	1279	1043	1796	1538	1705	1102	2245	1686	2132
	Peak Current @ Tmax ⑤	Ip	Arms	9.0	49.3	27.0	76	7.0	50	20.9	76.0	5.7	50	17.1	76
	Rated force @ Speed ⑤	Frtd	N	2484	2467	2480	2434	3485	3471	3482	3445	4311	4298	4308	4274
			lbf	558	555	558	547	783	780	783	774	969	966	968	961
400 VAC	Rated Speed	Nrtd	m/s	0.18	1.44	0.63	2.70	0.09	0.99	0.36	1.89	0.01	0.72	0.27	1.44
	Peak Force @ Tmax ⑤	Fp	N	5853	5949	5952	-	6865	7991	8057	-	7528	9988	10042	-
			lbf	1316	1337	1338	-	1543	1796	1811	-	1692	2245	2258	-
	Peak Current @ Tmax ⑤	Ip	Arms	15.7	49.3	28.5	-	12.2	50	29.9	-	9.9	50	29.6	-
	Rated force @ Speed ⑤	Frtd	N	2480	2434	2467	-	3482	3445	3471	-	4308	4274	4298	-
			lbf	558	547	555	-	783	774	780	-	968	961	966	-
480 VAC	Rated Speed	Nrtd	m/s	0.63	2.70	1.44	-	0.36	1.89	0.99	-	0.27	1.44	0.72	-
	Peak Force @ Tmax ⑤	Fp	N	5945	-	5952	-	7557	-	8057	-	8469	-	10042	-
			lbf	1336	-	1338	-	1699	-	1811	-	1904	-	2258	-
	Peak Current @ Tmax ⑤	Ip	Arms	16.4	-	28.5	-	14.6	-	29.9	-	11.9	-	29.6	-
	Rated force @ Speed ⑤	Frtd	N	2476	-	2459	-	3479	-	3464	-	4306	-	4292	-
			lbf	557	-	553	-	782	-	779	-	968	-	965	-
Electrical Specifications ②															
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	18.9	2.10	6.3	0.70	24.4	2.71	8.1	0.90	29.9	3.32	10.0	1.11
Electrical Inductance L-L	L	±20%	mh	232	25.8	77	8.6	307	34.1	102	11.4	382	42.4	127	14.1
Force Constant @ 25°C	Kf	±10%	N/Arms	537	179	310	103	716	239	414	138	896	299	517	172
			lbf/Arms	121	40.2	70	23.2	161	54	93	31	201	67	116	38.7
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	439	146	253	84	585	195	338	113	731	244	422	141
			Vpeak/in/sec	11	3.71	6	2.14	15	4.95	9	2.86	19	6	11	3.57
Figures of Merit and Additional Data															
Electrical Time Constant	Te		ms	12.3				12.6				12.8			
Max. Theoretical Acceleration ③	Amax		g's	22.3				22.9				23.3			
Magnetic Attraction	Fa		kN	22.1				29.4				36.8			
			lbf	4968				6609				8273			
Thermal Resistance ④	Rthw-a		°C/Watt	0.12				0.084				0.070			
Max. Allowable Coil Temp. ④	Tmax		°C	130											
Mechanical Specifications															
Coil Assembly Weight	Mc	±15%	kg	27.3				35.7				44.1			
			lbs	60				79				97			
Magnet Way Type (MCxxx)				150				200				250			
Magnet Way Weight	Mw	±15%	kg/m	20.7				26.8				33.2			
			lbs/in	1.16				1.5				1.86			

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC Ironcore DDL Motors

IC33 Ironcore Water-Cooled Motors Series Performance Data

Winding Code ②	Symbol	Tol	Units	IC33-030			IC33-050			IC33-075			IC33-100			
				A1	A3	A5										
230 VAC																
Max Rated Voltage	Un		VAC	480	230	480	480	230	480	480	230	480	480	230	480	
Max Continuous Force @ Tmax ① ⑤	Fc		N		761			1259			1877			2513		
Motor constant	Km		N/√W		0.289			0.307			0.339			0.372		
Continous Current @ Tmax	Ic		Arms	10.0	29.9	17.3	9.9	29.6	17.1	9.8	29.4	17.0	9.8	29.5	17.0	
Peak Force @ Tmax ⑤	Fp		N	1160	1160	1160	1925	1927	1927	2882	2880	2881	3483	3848	3850	
Peak Current @ Tmax ⑤	Ip		lbf	261	261	261	433	433	433	648	647	648	783	865	866	
Rated force @ Speed ⑤	Frtd		Arms	19.9	60	34.3	19.7	59	34.2	19.6	59	33.9	16.0	59	34.1	
Rated Speed	Nrtd		N	757	733	750	1255	1233	1250	1875	1856	1869	2510	2494	2506	
			lbf	170	165	169	282	277	281	422	417	420	564	561	563	
			m/s	2.52	9.2	4.95	1.35	5.4	2.79	0.63	3.42	1.71	0.270	2.43	1.17	
400 VAC																
Peak Force @ Tmax ⑤	Fp		N	1160	-	1160	1925	-	1927	2882	-	2881	3851	-	3850	
Peak Current @ Tmax ⑤	Ip		lbf	261	-	261	433	-	433	648	-	648	866	-	866	
Rated force @ Speed ⑤	Frtd		Arms	19.9	-	34.5	19.7	-	34.2	19.6	-	33.9	19.7	-	34.1	
Rated Speed	Nrtd		N	750	-	732	1250	-	1233	1869	-	1856	2506	-	2494	
			lbf	169	-	165	281	-	277	420	-	417	563	-	561	
			m/s	3.72	-	9.3	2.79	-	5.4	1.71	-	3.42	1.17	-	2.43	
480 VAC																
Peak Force @ Tmax ⑤	Fp		N	1160	-	1160	1925	-	1927	2882	-	2881	3851	-	3850	
Peak Current @ Tmax ⑤	Ip		lbf	261	-	261	433	-	433	648	-	648	866	-	866	
Rated force @ Speed ⑤	Frtd		Arms	19.9	-	34.5	19.7	-	34.2	19.6	-	33.9	19.7	-	34.1	
Rated Speed	Nrtd		N	746	-	720	1246	-	1223	1867	-	1846	2503	-	2486	
			lbf	168	-	162	280	-	275	420	-	415	563	-	559	
			m/s	6.1	-	11.3	3.51	-	6.7	2.16	-	4.32	1.53	-	3.06	
Electrical Specifications ②																
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	4.58	0.51	1.53	6.3	0.71	2.12	8.5	0.95	2.85	10.8	1.20	3.58	
Electrical Inductance L-L	L	±20%	mh	33.5	3.72	11.2	53.0	5.9	17.6	77	8.5	25.6	101	11.2	33.6	
Force Constant @ 25°C	Kf	±10%	N/Arms	86	28.7	49.7	144	47.8	83	215	72	124	287	96	166	
			lbf/Arms	19.3	6.5	11.2	32.4	10.7	18.7	48.3	16.2	27.9	65	21.6	37.3	
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	70	23.4	40.6	117	39.1	68	176	59	101	234	78	135	
			Vpeak/in/sec	1.79	0.6	1.03	2.98	0.99	1.72	4.46	1.49	2.58	6	1.98	3.44	
Figures of Merit and Additional Data																
Electrical Time Constant	Te		ms		7.3			8.4			9.1			9.4		
Max. Theoretical Acceleration ③	Amax		g's		16.2			18.9			20.4			20.8		
Magnetic Attraction	Fa		kN		4.40			7.4			11.0			14.7		
			lbf		989			1664			2473			3305		
Thermal Resistance ④	Rthw-a		°C/Watt		0.110			0.081			0.061			0.048		
Max. Allowable Coil Temp. ④	Tmax		°C					130								
Min. Flow Rate of Coolant @ 25°C Max.			liters/min						2.8							
Mechanical Specifications																
Coil Assembly Weight	Mc	±15%	kg		7.3			10.4			14.4			18.9		
			lbs		16.1			22.9			31.7			41.7		
Magnet Way Type (MCxxx)					030			050			075			100		
Magnet Way Weight	Mw	±15%	kg/m		5.4			7.5			10.1			12.7		
			lbs/in		0.302			0.42			0.57			0.71		

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC33 Ironcore Water-Cooled Motors Series Performance Data (Continued)

Winding Code ②	Symbol	Tol	Units	IC33-150			IC33-200			IC33-250		
				A1	A3	A5	A1	A3	A5	A1	A3	A5
Rated Performance												
Max Rated Voltage	Un		VAC	480	230	480	480	230	480	480	230	480
Max Continuous Force @ Tmax ① ⑤	Fc		N	3729			4979			6021		
			lbf	838			1119			1354		
Motor constant	Km		N·V/W	0.43			0.48			0.53		
Continuous Current @ Tmax	Ic		Arms	9.7	29.1	16.8	9.7	29.2	16.8	9.3	27.9	16.1
Peak Force @ Tmax ⑤	Fp		N	4173	5741	5741	-	7660	6745	-	9408	7394
			lbf	938	1291	1291	-	1722	1516	-	2115	1662
Peak Current @ Tmax ⑤	Ip		Arms	11.3	58	33.6	-	58	26.1	-	56	21.3
Rated force @ Speed ⑤	Frtd		N	3728	3725	3725	-	4967	4977	-	6012	6020
			lbf	838	837	837	-	1117	1119	-	1352	1353
Rated Speed	Nrtd		m/s	0.020	1.44	0.54	-	0.99	0.27	-	0.63	0.120
Peak Force @ Tmax ⑤	Fp		N	5741	-	5741	6764	-	7664	7417	-	9411
			lbf	1291	-	1291	1521	-	1723	1667	-	2116
Peak Current @ Tmax ⑤	Ip		Arms	19.4	-	33.6	15.2	-	33.7	12.4	-	32.3
Rated force @ Speed ⑤	Frtd		N	3725	-	3714	4977	-	4967	6020	-	6012
			lbf	837	-	835	1119	-	1117	1353	-	1352
Rated Speed	Nrtd		m/s	0.54	-	1.44	0.27	-	0.99	0.12	-	0.63
Peak Force @ Tmax ⑤	Fp		N	5741	-	5741	7446	-	7664	8344	-	9411
			lbf	1291	-	1291	1674	-	1723	1876	-	2116
Peak Current @ Tmax ⑤	Ip		Arms	19.4	-	33.6	18.2	-	33.7	14.8	-	32.3
Rated force @ Speed ⑤	Frtd		N	3722	-	3707	4975	-	4962	6019	-	6005
			lbf	837	-	833	1118	-	1116	1353	-	1350
Rated Speed	Nrtd		m/s	0.81	-	1.89	0.45	-	1.26	0.27	-	0.99
Electrical Specifications ①												
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	15.2	1.68	5.1	19.6	2.17	6.5	24.0	2.66	8.0
Electrical Inductance L-L	L	±20%	mh	149	16.5	49.6	197	21.9	66	245	27.2	82
Force Constant @ 25°C	Kf	±10%	N/Arms	431	144	249	574	191	331	718	239	414
			lbf/Arms	97	32.4	56	129	42.9	74	161	54	93
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	352	117	203	469	156	271	586	195	338
			Vpeak/in/sec	9	2.98	5	12	3.97	7	15	4.96	9
Figures of Merit and Additional Data												
Electrical Time Constant	Te		ms	9.8			10.1			10.2		
Max. Theoretical Acceleration ③	Amax		g's	21.5			21.8			21.8		
Magnetic Attraction	Fa		kN	22.1			29.4			36.8		
			lbf	4968			6609			8273		
Thermal Resistance ④	Rthw-a		°C/Watt	0.035			0.027			0.022		
Max. Allowable Coil Temp. ④	Tmax		°C	130								
Min. Flow Rate of Coolant @ 25°C Max.			liters/min	2.8								
Mechanical Specifications												
Coil Assembly Weight	Mc	±15%	kg	27.3			35.7			44.1		
Magnet Way Type (MCxxx)			lbs	60			79			97		
Magnet Way Weight			Mw	±15%	kg/m	150	200	250				
				lbs/in	20.7	26.8	33.2					
					1.16	1.5	1.86					

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC Ironcore DDL Motors

IC44 Ironcore Natural-Cooled Motors Series Performance Data

Winding Code ②	Symbol	Tol	Units	IC44-030				IC44-050				IC44-075				IC44-100											
				A1	A2	A3	A7																				
Rated Performance																											
Max Rated Voltage	Un		VAC	480	480	230	230	480	480	230	230	480	480	400	230	480	480	480	230								
Max Continuous Force @ Tmax ① ⑤	Fc			N	568				1028				1609				2186										
Motor constant	Km		N/VW	0.55				0.57				0.61				0.66											
Continous Current @ Tmax	Ic		Arms	4.02	8.0	16.1	27.9	4.37	8.7	17.5	30.3	4.56	9.1	18.2	31.6	4.64	9.3	18.6	32.2								
Peak Force @ Tmax ⑤	Fp	N	1487	1487	1486	1293	2573	2573	2573	2573	2156	3403	3923	3505	3234	3903	5267	4176	4311								
		Ibf	334	334	334	291	578	578	578	578	485	765	882	788	727	877	1184	939	969								
Peak Current @ Tmax ⑤	Ip		Arms	14.1	28.2	56	76	15.3	30.6	61	76	12.0	31.9	50	76	9.5	32.5	42.0	76								
Rated force @ Speed ⑤	Frtd	N	563	555	524	455	1025	1017	990	922	1607	1600	1576	1520	2184	2178	2157	2104									
		Ibf	127	125	118	102	230	229	223	207	361	360	354	342	491	490	485	473									
Rated Speed	Nrtd	m/s	1.80	3.96	8.4	13.5	0.90	2.25	4.86	8.7	0.45	1.35	3.15	5.7	0.270	0.99	2.25	4.23									
Peak Force @ Tmax ⑤	Fp	N	1487	1487	-	-	2573	2573	-	-	3928	3923	3505	-	5273	5267	4176	-									
		Ibf	334	334	-	-	578	578	-	-	883	882	788	-	1185	1184	939	-									
Peak Current @ Tmax ⑤	Ip		Arms	14.1	28.2	-	-	15.3	30.6	-	-	16.0	31.9	50.4	-	16.3	32.5	42.0	-								
Rated force @ Speed ⑤	Frtd	N	557	533	-	-	1020	999	-	-	1602	1583	1518	-	2179	2165	2104	-									
		Ibf	125	120	-	-	229	225	-	-	360	356	341	-	490	487	473	-									
Rated Speed	Nrtd	m/s	3.42	7.2	-	-	1.89	4.14	-	-	1.17	2.70	5.8	-	0.81	1.89	4.23	-									
Peak Force @ Tmax ⑤	Fp	N	1487	1487	-	-	2573	2573	-	-	3928	3923	-	-	5273	5267	4176	-									
		Ibf	334	334	-	-	578	578	-	-	883	882	-	-	1185	1184	939	-									
Peak Current @ Tmax ⑤	Ip		Arms	14.1	28.2	-	-	15.3	30.6	-	-	16.0	31.9	-	-	16.3	32.5	42.0	-								
Rated force @ Speed ⑤	Frtd	N	554	519	-	-	1016	987	-	-	1599	1574	-	-	2178	2155	2071	-									
		Ibf	125	117	-	-	228	222	-	-	359	354	-	-	490	484	466	-									
Rated Speed	Nrtd	m/s	4.14	8.8	-	-	2.34	5.1	-	-	1.44	3.24	-	-	0.99	2.34	5.1	-									
Electrical Specifications ②																											
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	7.5	1.89	0.48	0.160	10.5	2.63	0.66	0.221	14.1	3.54	0.89	0.297	17.8	4.46	1.12	0.374								
Electrical Inductance L-L	L	±20%	mh	70	17.4	4.35	1.45	110	27.4	6.8	2.28	159	39.9	10.0	3.32	209	52	13.1	4.36								
Force Constant @ 25°C	Kf	±10%	N/Arms	143	72	35.8	20.7	239	119	60	34.5	358	179	90	52	478	239	119	69								
			Ibf/Arms	32.1	16.2	8	4.65	54	26.8	13.5	7.8	80	40.2	20.2	11.7	107	54	26.8	15.5								
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	117	59	29.3	16.9	195	98	48.8	28.2	293	146	73	42.2	390	195	98	56								
			Vpeak/in/sec	2.97	1.49	0.74	0.43	4.95	2.48	1.24	0.72	7	3.71	1.86	1.07	10	4.95	2.48	1.43								
Figures of Merit and Additional Data																											
Electrical Time Constant	Te		ms	9.3				10.5				11.3				11.7											
Max. Theoretical Acceleration ③	Amax		g's	15.8				18.9				20.9				21.5											
Magnetic Attraction	Fa		kN	5.9				9.8				14.7				19.6											
			Ibf	1326				2203				3305				4406											
Thermal Resistance ④	Rthw-a		°C/Watt	0.41				0.250				0.170				0.130											
Max. Allowable Coil Temp. ④	Tmax		°C	130																							
Mechanical Specifications																											
Coil Assembly Weight	Mc	±15%	kg	9.6				13.9				19.2				25.0											
Magnet Way Type (MCxxx)			Ibs	21.2				30.6				42.3				55											
				030				050				075				100											
Magnet Way Weight	Mw	±15%	kg/m	5.4				7.5				10.1				12.7											
			lbs/in	0.302				0.42				0.57				0.71											

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC44 Ironcore Natural-Cooled Motors Series Performance Data (Continued)

Winding Code ②	Symbol	Tol	Units	IC44-150				IC44-200				IC44-250			
				A1	A2	A3	A7	A1	A2	A3	A7	A1	A2	A3	A7
Rated Performance															
Max Rated Voltage	Un		VAC	480	480	480	230	480	480	480	230	480	480	480	230
Max Continuous Force @ Tmax ① ⑤	Fc		N	3353				4649				5834			
			lbf	754				1045				1312			
Motor constant	Km		N/VW	0.75				0.82				0.9			
Continous Current @ Tmax	Ic		Arms	4.75	9.5	19.0	32.9	4.94	9.9	19.8	34.2	4.96	9.9	19.8	34.4
Peak Force @ Tmax ⑤	Fp		N	4505	7264	6264	6467	-	8309	8352	8623	-	8996	10440	10779
			lbf	1013	1633	1408	1454	-	1868	1878	1939	-	2022	2347	2423
Peak Current @ Tmax ⑤	Ip		Arms	6.7	26.9	42.0	76	-	20.8	42.0	76	-	17.0	42.0	76
Rated force @ Speed ⑤	Frtd		N	3352	3347	3329	3285	-	4646	4630	4595	-	5830	5816	5784
			lbf	754	752	748	738	-	1044	1041	1033	-	1311	1307	1300
Rated Speed	Nrtd		m/s	0.090	0.54	1.44	2.70	-	0.27	0.99	1.89	-	0.180	0.72	1.44
230 VAC	Fp		N	6716	7967	6264	-	7546	10750	8352	-	8090	12637	10440	-
			lbf	1510	1791	1408	-	1696	2417	1878	-	1819	2841	2347	-
Peak Current @ Tmax ⑤	Ip		Arms	11.7	33.3	42.0	-	9.1	34.6	42.0	-	7.4	29.6	42.0	-
400 VAC	Frtd		N	3350	3336	3285	-	4647	4633	4595	-	5832	5822	5784	-
			lbf	753	750	738	-	1045	1042	1033	-	1311	1309	1300	-
Rated Speed	Nrtd		m/s	0.360	1.17	2.70	-	0.18	0.81	1.89	-	0.11	0.54	1.44	-
480 VAC	Fp		N	7426	7967	6264	-	8550	10750	8352	-	9288	13448	10440	-
			lbf	1669	1791	1408	-	1922	2417	1878	-	2088	3023	2347	-
Peak Current @ Tmax ⑤	Ip		Arms	14.1	33.3	42.0	-	10.9	34.6	42.0	-	8.9	34.7	42.0	-
Rated force @ Speed ⑤	Frtd		N	3347	3328	3257	-	4646	4630	4569	-	5830	5816	5761	-
			lbf	752	748	732	-	1044	1041	1027	-	1311	1307	1295	-
Rated Speed	Nrtd		m/s	0.54	1.44	3.33	-	0.27	0.90	2.34	-	0.18	0.72	1.80	-
Electrical Specifications ②															
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	25.1	6.3	1.58	0.53	32.5	8.1	2.03	0.68	39.8	10.0	2.49	0.83
Electrical Inductance L-L	L	±20%	mh	309	77	19.3	6.4	409	102	25.6	8.5	510	127	31.8	10.6
Force Constant @ 25°C	Kf	±10%	N/Arms	716	358	179	103	955	478	239	138	1194	597	299	172
			lbf/Arms	161	80	40.2	23.2	215	107	54	31	268	134	67	38.7
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	585	293	146	84	780	390	195	113	975	488	244	141
			Vpeak/in/sec	15	7	3.71	2.14	20	10	4.95	2.86	25	12	6	3.57
Figures of Merit and Additional Data															
Electrical Time Constant	Te		ms	12.3				12.6				12.8			
Max. Theoretical Acceleration ③	Amax		g's	22.4				23.2				23.4			
Magnetic Attraction	Fa		kN	29.4				39.4				49.2			
			lbf	6609				8857				11061			
Thermal Resistance ④	Rthw-a		°C/Watt	0.088				0.063				0.052			
Max. Allowable Coil Temp. ④	Tmax		°C	130											
Mechanical Specifications															
Coil Assembly Weight	Mc	±15%	kg	36.2				47.4				58.5			
			lbs	80				104				129			
Magnet Way Type (MCxxx)															
Magnet Way Weight	Mw	±15%	kg/m	20.7				26.8				33.2			
			lbs/in	1.16				1.5				1.86			

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC Ironcore DDL Motors

IC44 Ironcore Water-Cooled Motors Series Performance Data

Winding Code ②	Symbol	Tol	Units	IC44-030			IC44-050			IC44-075			IC44-100		
				A1	A2	A3	A1	A2	A3	A1	A2	A3	A1	A2	A3
Rated Performance															
Max Rated Voltage	Un		VAC	480	480	230	480	480	230	480	480	230	480	480	230
Max Continuous Force @ Tmax ① ⑤	Fc			N	1019		1678			2500			3352		
			Ibf		229		377			562			754		
Motor constant	Km		N/√W		0.33		0.354			0.393			0.43		
Continous Current @ Tmax	Ic		Arms	10.0	20.0	40.1	9.9	19.7	39.4	9.8	19.5	39.1	9.8	19.7	39.4
Peak Force @ Tmax ⑤	Fp		N	1549	1551	1521	2567	2567	2535	3347	3839	3803	3839	5134	5071
			Ibf	348	349	342	577	577	570	752	863	855	863	1154	1140
Peak Current @ Tmax ⑤	Ip		Arms	20.0	40.1	76	19.7	39.4	76	14.9	39.1	76	11.8	39.4	76
Rated force @ Speed ⑤	Frtd		N	1016	1008	981	1675	1668	1644	2499	2492	2471	3352	3346	3327
			Ibf	228	227	221	377	375	370	562	560	556	754	752	748
Rated Speed	Nrtd		m/s	1.62	4.14	9.2	0.72	2.34	5.4	0.27	1.35	3.42	0.05	0.90	2.43
Peak Force @ Tmax ⑤	Fp		N	1549	1551	-	2567	2567	-	3835	3839	-	5134	5134	-
			Ibf	348	349	-	577	577	-	862	863	-	1154	1154	-
Peak Current @ Tmax ⑤	Ip		Arms	20.0	40.1	-	19.7	39.4	-	19.5	39.1	-	19.7	39.4	-
Rated force @ Speed ⑤	Frtd		N	1010	989	-	1671	1652	-	2494	2478	-	3348	3333	-
			Ibf	227	222	-	376	371	-	561	557	-	753	749	-
Rated Speed	Nrtd		m/s	3.51	7.8	-	1.89	4.59	-	1.08	2.88	-	0.63	2.07	-
Peak Force @ Tmax ⑤	Fp		N	1549	1551	-	2567	2567	-	3835	3839	-	5134	5134	-
			Ibf	348	349	-	577	577	-	862	863	-	1154	1154	-
Peak Current @ Tmax ⑤	Ip		Arms	20.0	40.1	-	19.7	39.4	-	19.5	39.1	-	19.7	39.4	-
Rated force @ Speed ⑤	Frtd		N	1007	978	-	1667	1642	-	2492	2468	-	3346	3324	-
			Ibf	226	220	-	375	369	-	560	555	-	752	747	-
Rated Speed	Nrtd		m/s	4.32	9.6	-	2.43	5.7	-	1.44	3.60	-	0.99	2.61	-
Electrical Specifications ②															
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	6.08	1.52	0.382	8.4	2.11	0.53	11.4	2.84	0.71	14.3	3.58	0.90
Electrical Inductance L-L	L	±20%	mh	44.7	11.2	2.79	70	17.6	4.39	102	25.6	6.4	134	33.6	8.4
Force Constant @ 25°C	Kf	±10%	N/Arms	115	57	28.7	191	96	47.8	287	144	72	383	191	96
			Ibf/Arms	25.9	12.8	6.5	42.9	21.6	10.7	65	32.4	16.2	86	42.9	21.6
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	94	46.9	23.4	156	78	39.1	234	117	59	313	156	78
			Vpeak/in/sec	2.38	1.19	0.6	3.97	1.98	0.99	6	2.98	1.49	8	3.97	1.98
Figures of Merit and Additional Data															
Electrical Time Constant	Te		ms		7.4		8.3			8.9			9.4		
Max. Theoretical Acceleration ③	Amax		g's		16.5		18.9			20.4			21.0		
Magnetic Attraction	Fa		kN		5.9		9.8			14.7			19.6		
			Ibf		1326		2203			3305			4406		
Thermal Resistance ④	Rthw-a		°C/Watt		0.082		0.061			0.046			0.036		
Max. Allowable Coil Temp. ④	Tmax		°C						130						
Min. Flow Rate of Coolant @ 25°C Max.			liters/min							2.8					
Mechanical Specifications															
Coil Assembly Weight	Mc	±15%	kg		9.6		13.9			19.2			25.0		
			lbs		21.2		30.6			42.3			55		
Magnet Way Type (MCxxx)					030		050			075			100		
Magnet Way Weight	Mw	±15%	kg/m		5.4		7.5			10.1			12.7		
			lbs/in		0.302		0.42			0.57			0.71		

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC44 Ironcore Water-Cooled Motors Series Performance Data (Continued)

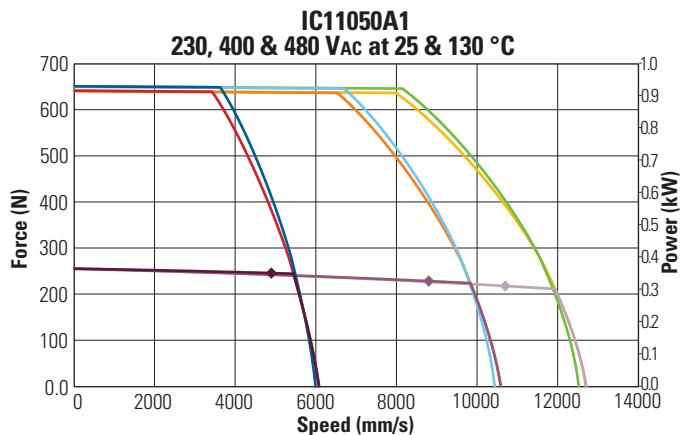
Winding Code ②	Symbol	Tol	Units	IC44-150			IC44-200			IC44-250		
				A1	A2	A3	A1	A2	A3	A1	A2	A3
Rated Performance												
Max Rated Voltage	Un		VAC	480	480	230	480	480	230	480	480	230
Max Continuous Force @ Tmax ① ⑤	Fc		N	4992			6673			8211		
			lbf	1122			1500			1846		
Motor constant	Km		N·V/W	0.49			0.55			0.61		
Continuous Current @ Tmax	Ic		Arms	9.8	19.5	39.0	9.8	19.6	39.1	9.6	19.2	38.4
Peak Force @ Tmax ⑤	Fp		N	-	7153	7606	-	8183	10142	-	-	12677
			lbf	-	1608	1710	-	1840	2280	-	-	2850
Peak Current @ Tmax ⑤	Ip		Arms	-	33.5	76	-	26.0	76	-	-	76
Rated force @ Speed ⑤	Frtd		N	-	4989	4972	-	6671	6657	-	-	8198
			lbf	-	1122	1118	-	1500	1497	-	-	1843
Rated Speed	Nrtd		m/s	-	0.36	1.44	-	0.130	0.99	-	-	0.63
Peak Force @ Tmax ⑤	Fp		N	6610	7671	-	7428	10238	-	-	12484	-
			lbf	1486	1725	-	1670	2302	-	-	2807	-
Peak Current @ Tmax ⑤	Ip		Arms	14.6	39.0	-	11.3	39.1	-	-	36.9	-
Rated force @ Speed ⑤	Frtd		N	4990	4978	-	6673	6662	-	-	8203	-
			lbf	1122	1119	-	1500	1498	-	-	1844	-
Rated Speed	Nrtd		m/s	0.18	1.17	-	0.010	0.72	-	-	0.45	-
Peak Force @ Tmax ⑤	Fp		N	7311	7671	-	8417	10238	-	9144	12705	-
			lbf	1644	1725	-	1892	2302	-	2056	2856	-
Peak Current @ Tmax ⑤	Ip		Arms	17.5	39.0	-	13.6	39.1	-	11.1	38.4	-
Rated force @ Speed ⑤	Frtd		N	4989	4970	-	6671	6657	-	8211	8196	-
			lbf	1122	1117	-	1500	1497	-	1846	1843	-
Rated Speed	Nrtd		m/s	0.36	1.53	-	0.160	0.99	-	0.01	0.72	-
Electrical Specifications ②												
Electrical Resistance @ 25°C L-L	Rm	±10%	Ohms	20.2	5.0	1.26	26.0	6.5	1.63	31.9	8.0	2.00
Electrical Inductance L-L	L	±20%	mh	198	49.6	12.4	263	66	16.4	327	82	20.4
Force Constant @ 25°C	Kf	±10%	N/Arms	574	287	144	765	383	191	957	478	239
			lbf/Arms	129	65	32.4	172	86	42.9	215	107	54
Back EMF Constant @ 25°C L-L	Ke	±10%	Vpeak/m/s	469	234	117	625	313	156	781	391	195
			Vpeak/in/sec	12	6	2.98	16	8	3.97	20	10	4.96
Figures of Merit and Additional Data												
Electrical Time Constant	Te		ms	9.8			10.1			10.2		
Max. Theoretical Acceleration ③	Amax		g's	21.6			22.1			22.1		
Magnetic Attraction	Fa		kN	29.4			39.4			49.2		
			lbf	6609			8857			11061		
Thermal Resistance ④	Rthw-a		°C/Watt	0.026			0.020			0.017		
Max. Allowable Coil Temp. ④	Tmax		°C				130					
Min. Flow Rate of Coolant @ 25°C Max.			liters/min				2.8					
Mechanical Specifications												
Coil Assembly Weight	Mc	±15%	kg	36.2			47.4			58.5		
			lbs	80			104			129		
Magnet Way Type (MCxxx)				150			200			250		
Magnet Way Weight	Mw	±15%	kg/m	20.7			26.8			33.2		
			lbs/in	1.16			1.5			1.86		

Notes:

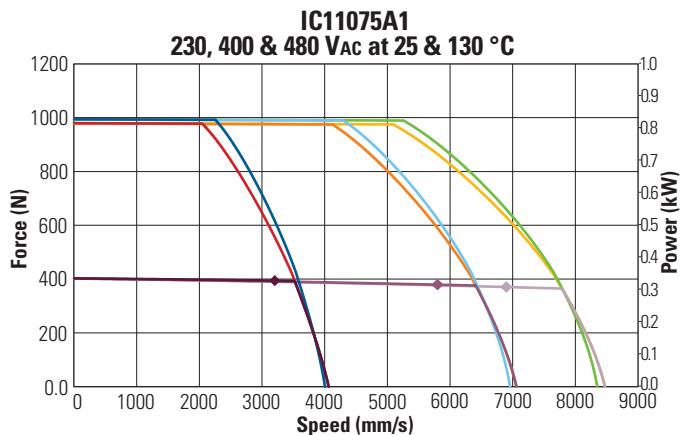
- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.
- ⑤ All data referenced to sinusoidal commutation

IC Ironcore DDL Motors

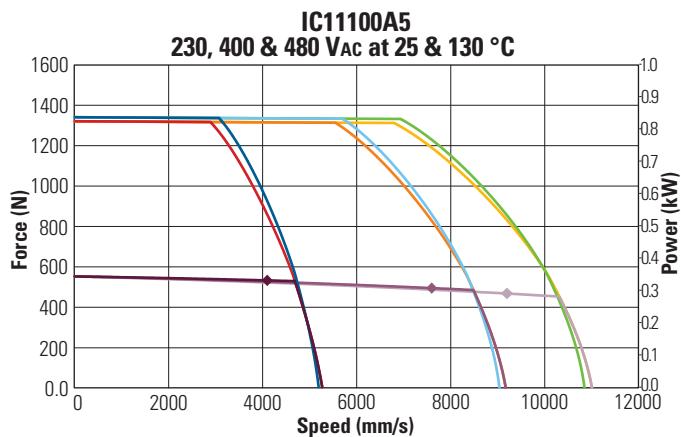
ICxx Performance Curves



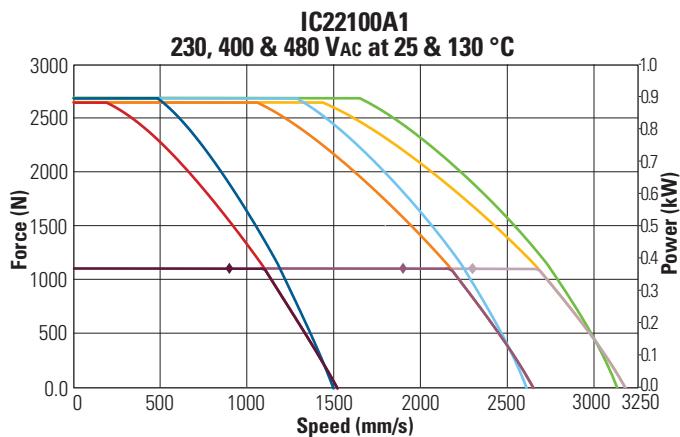
I_{pk} Motor winding @ 130 °C: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
I_{pk} Motor winding @ 25 °C ambient: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
Rated Power: ♦ 230 ♦ 400 ♦ 480 SOAC (cont. operation): — 230 — 400 — 480



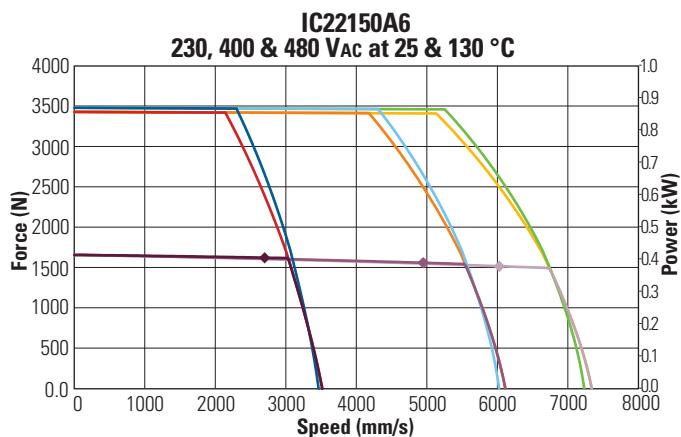
I_{pk} Motor winding @ 130 °C: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
I_{pk} Motor winding @ 25 °C ambient: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
Rated Power: ♦ 230 ♦ 400 ♦ 480 SOAC (cont. operation): — 230 — 400 — 480



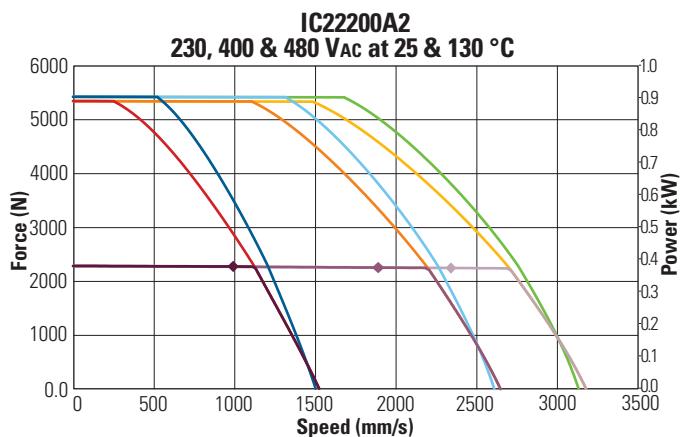
I_{pk} Motor winding @ 130 °C: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
I_{pk} Motor winding @ 25 °C ambient: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
Rated Power: ♦ 230 ♦ 400 ♦ 480 SOAC (cont. operation): — 230 — 400 — 480



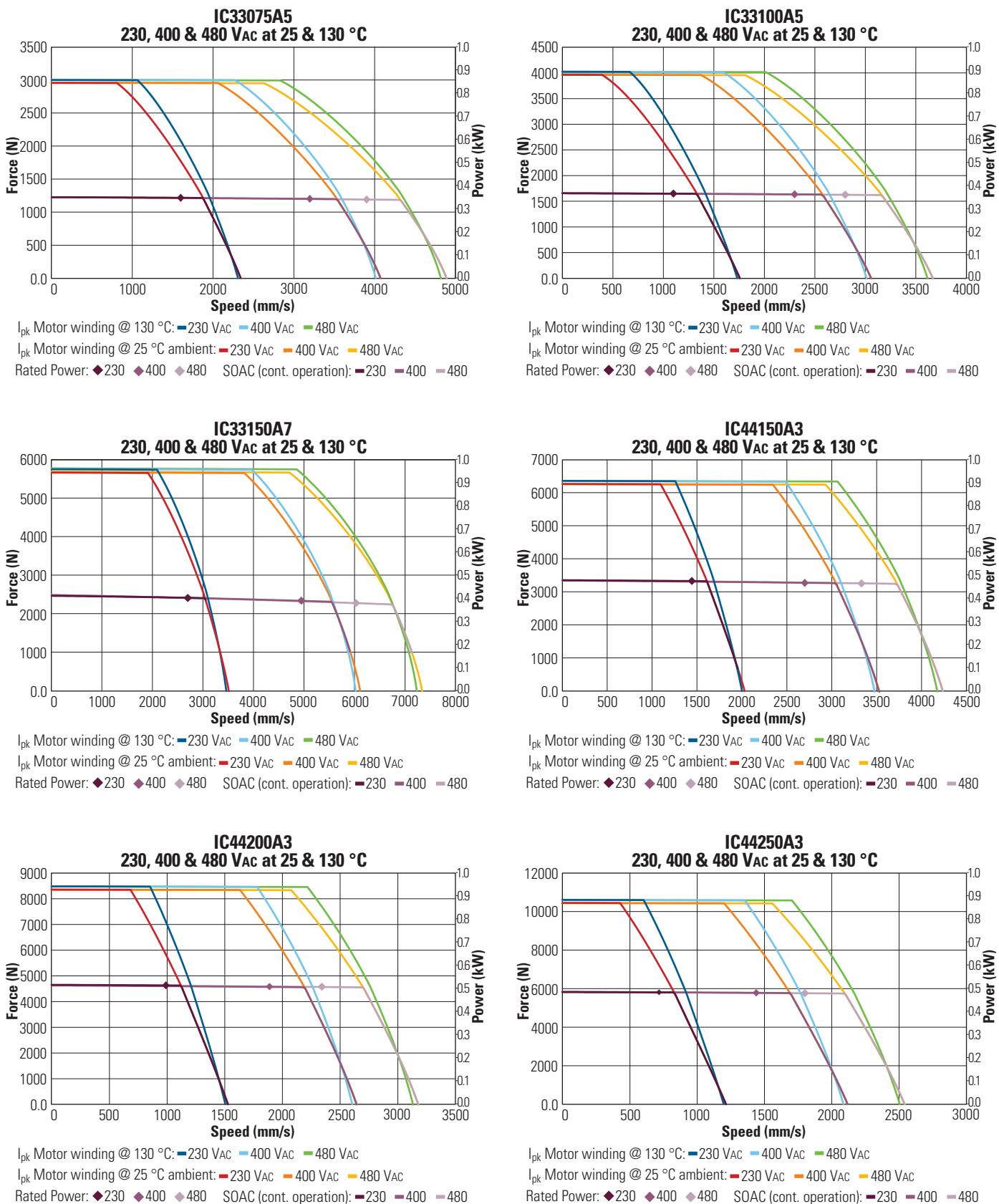
I_{pk} Motor winding @ 130 °C: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
I_{pk} Motor winding @ 25 °C ambient: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
Rated Power: ♦ 230 ♦ 400 ♦ 480 SOAC (cont. operation): — 230 — 400 — 480



I_{pk} Motor winding @ 130 °C: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
I_{pk} Motor winding @ 25 °C ambient: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
Rated Power: ♦ 230 ♦ 400 ♦ 480 SOAC (cont. operation): — 230 — 400 — 480



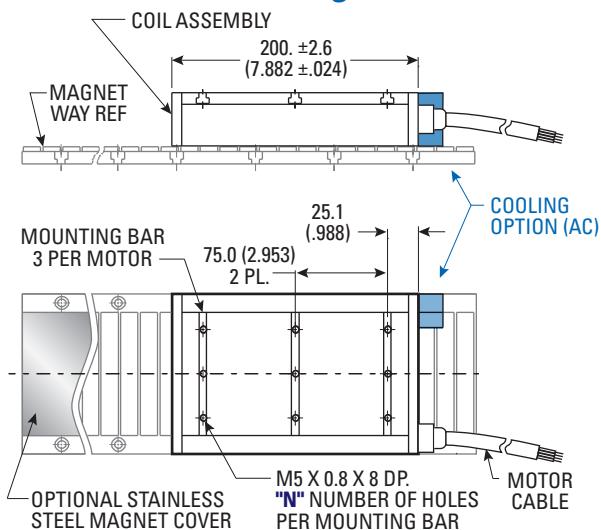
I_{pk} Motor winding @ 130 °C: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
I_{pk} Motor winding @ 25 °C ambient: — 230 V_{AC} — 400 V_{AC} — 480 V_{AC}
Rated Power: ♦ 230 ♦ 400 ♦ 480 SOAC (cont. operation): — 230 — 400 — 480



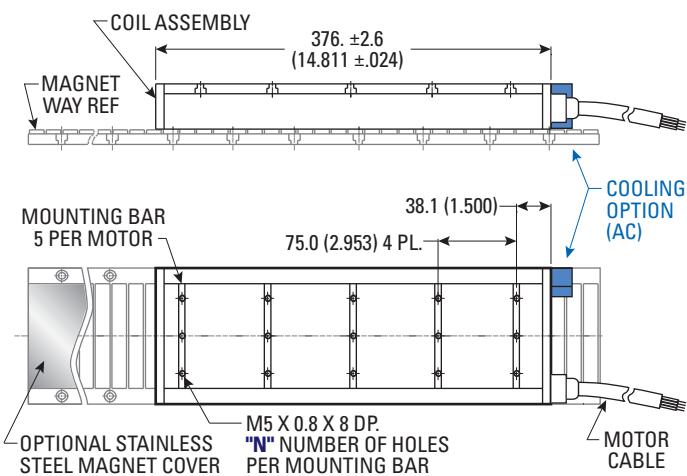
IC Ironcore DDL Motors

ICxx Coil Series Dimensional Drawings

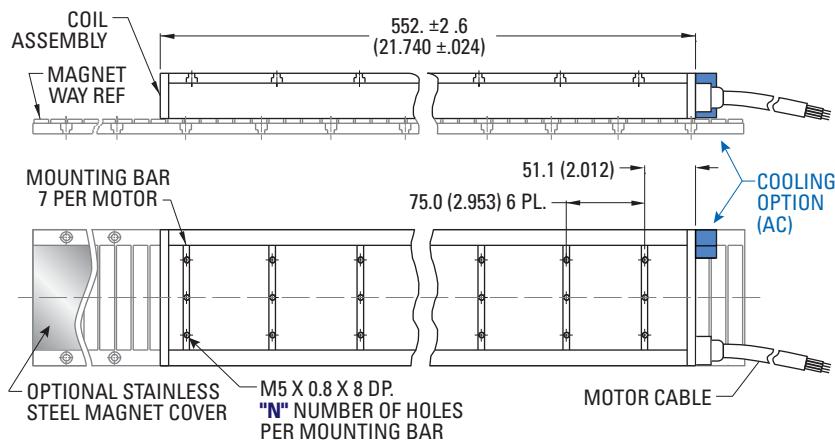
IC11 Dimensional Drawings



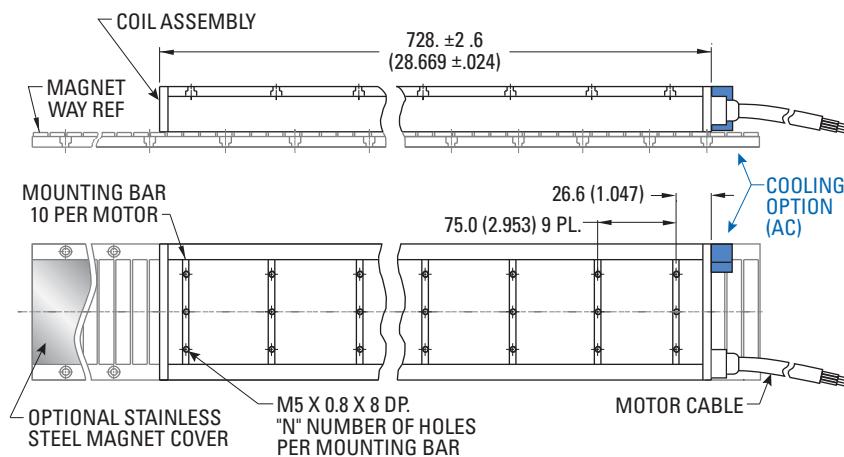
IC22 Dimensional Drawings



IC33 Dimensional Drawings

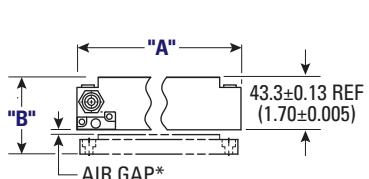


IC44 Dimensional Drawings



Dimensions in mm (in)

ICxx Typical Coil Type Dimensional Drawings and Data



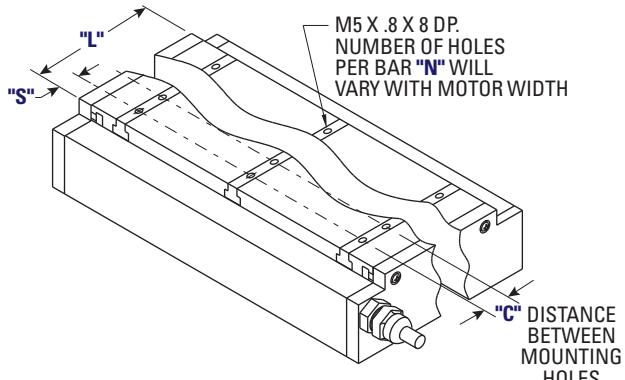
*AIR GAP:

A suitable air gap should be set to ensure that the feeler gauge of the corresponding size can pass smoothly between the coil and the magnetic circuit.

For the magnetic circuit without cover, the air gap is 0.8 ± 0.1 mm

For the covered magnetic circuit, the air gap is 0.55 ± 0.1 mm

(Stainless steel cover plate thickness 0.25 mm)

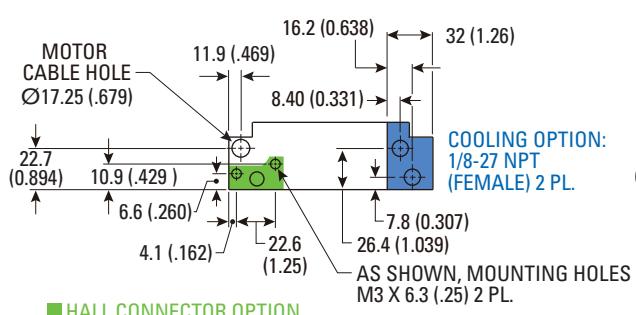


ICxx Dimensional Data, Typical Mounting Bar Lengths & Mounting Holes Tabulation

Motor Coil Type	Coil Width "A"	Height w/ Air Gap		Spacing Between Holes "C"	Mounting Bar Length "L"	# Holes "N"	Hole Size "S"	Note: 1. Dimensions in mm (inches) 2. Tolerances (unless otherwise specified): No decimal places: ± 0.8 One decimal place: ± 0.1 Two decimal places: ± 0.05
		"B" w/ mag. cvr	"B" w/o mag. cvr					
ICxx030	65.0 (2.559) ± 1.0 (.04)	58.6 ± 0.1 (2.307 \pm .004)	58.3 ± 0.1 (2.295 \pm .004)	16.0 (0.630)	30 (1.18)	2	7.0 (0.28)	
ICxx050	85.0 (3.346) ± 1.0 (.04)			36.0 (1.417)	50 (1.97)	2	7.0 (0.28)	
ICxx075	110.0 (4.331) ± 1.0 (.04)			32.0 (1.260)	75 (2.95)	3	5.5 (0.21)	
ICxx100	135.0 (5.315) ± 1.0 (.04)			36.0 (1.417)	100 (3.94)	3	14.0 (0.55)	
ICxx150	185.0 (7.283) ± 1.5 (.06)	60.6 ± 0.1 (2.386 \pm .004)	60.3 ± 0.1 (2.374 \pm .004)	32.0 (1.260)	150 (5.91)	5	11.0 (0.43)	
ICxx200	235.0 (9.252) ± 1.5 (.06)			36.0 (1.417)	200 (7.87)	6	10.0 (0.39)	
ICxx250	285.0 (11.22) ± 1.5 (.06)			38.0 (1.496)	250 (9.84)	7	11.0 (0.43)	

Dimensions in mm (in)

ICxx Typical Cable Port and Cooling Unit Dimensions



HALL CONNECTOR OPTION



Optional Cooling Unit



Optional IC Hall Effect
Connector Cable



► ICD Low-Profile Ironcore DDL Motors

Ironcore DDL linear motors have a compact profile to provide force moving load.

General Specifications

- » Coil frame size 05, 10
- » Coil width 030, 050, 075, 100
- » Low and high-speed coil winding designs fit various application needs

ICD05/10

Peak force range	165 – 1099N
Continuous force range	57 – 315 N
Insulation voltage rating	230VAC
Cooling options	Natural-cooled only
Feedback	Optional hall sensor
Thermal Devices	Thermistor – PTC
Certification	RoHS, REACH



ICD10



REACH ✓

ICD05 Low Profile Ironcore Motor Performance Data

	Symbol	Units	ICD05030	ICD05050	ICD05075	ICD05100	
Rated Performance							
Peak Force	Fp	N	165	295	441	588	
		lbf	37.1	66.3	99.1	132	
Continuous Force @ Tmax ^①	Fc	N	57.0	87.0	125	157	
		lbf	12.8	19.6	28.1	35.3	
Motor Constant @ 25°C	Km	N/√W	12.3	17.2	22.0	26.0	
		lbf/√W	2.8	3.9	4.9	5.9	
Electrical Specifications							
Winding Code ②			A1	A5	A1	A5	
Peak Current	I _p	Arms	7.9	13.7	8.5	14.7	
Continuous Current @ Tmax	I _c	Arms	2.1	3.7	2.0	3.4	
Electrical Resistance @ 25°C±10%	R _m	Ohms L-L	3.2	1.1	4.5	1.5	
Electrical Inductance ±20%	L	mh L-L	9.1	3.0	14.4	4.8	
Back EMF Constant @ 25°C±10%	Ke	Vpeak/m/s L-L	21.8	12.6	36.3	21.0	
		Vpeak/in/sec L-L	0.55	0.32	0.92	0.53	
Force Constant @ 25°C±10%	K _f	N/Arms	26.7	15.4	44.5	25.7	
		lbf/Arms	6.0	3.5	10.0	5.8	
Mechanical Specifications							
Coil Assembly Weight ±15%	M _c	kg	0.62	0.95	1.36	1.71	
		lbs	1.4	2.1	3.0	3.8	
Magnetic Way Type (MCDxxx)			030	050	075	100	
Magnetic Way Weight ±15%	M _w	kg/m	2.70	3.93	5.48	7.04	
		lbs/in	0.15	0.22	0.31	0.39	
Figures of Merit and Additional Data							
Electrical Time Constant	T _e	ms	2.9	3.2	3.4	3.6	
Max. Theoretical Acceleration ^③	A _{max}	g's	28.0	30.2	31.9	32.8	
Magnetic Attraction	F _a	kN	0.53	0.89	1.33	1.78	
		lbf	119	200	299	400	
Thermal Resistance ^④ (Coils to External Structure)	R _{th}	°C/Watt	3.50	2.90	2.30	2.06	
Max. Allowable Coil Temp. ^④	T _{max}	°C	130	130	130	130	

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.

ICD Low-Profile Ironcore DDL Motors

ICD10 Low Profile Ironcore Motor Performance Data

	Symbol	Units	ICD10030				ICD10050				
Rated Performance											
Peak Force	Fp	N	330				550				
		lbf	74.2				124				
Continuous Force @ Tmax ①	Fc	N	104				171				
		lbf	23.4				38.4				
Motor Constant @ 25°C	Km	N/√W	17.3				24.3				
		lbf/√W	3.9				5.5				
Electrical Specifications											
Winding Code ②			A1	A4	A5	A8	A1	A4	A5	A8	
Peak Current	I _p	Arms	7.9	15.8	13.7	27.4	7.9	15.8	13.7	27.4	
Continuous Current @ Tmax	I _c	Arms	1.9	3.9	3.4	6.8	1.9	3.8	3.3	6.6	
Electrical Resistance @ 25°C±10%	R _m	Ohms L-L	6.4	1.6	2.1	0.5	9.0	2.2	3.0	0.7	
Electrical Inductance ±20%	L	mh L-L	18.3	4.6	6.1	1.5	29.0	7.3	9.7	2.4	
Back EMF Constant @ 25°C±10%	Ke	Vpeak/m/s L-L	43.7	21.8	25.2	12.6	72.8	36.4	42.0	21.0	
		Vpeak/in/sec L-L	1.11	0.55	0.64	0.32	1.85	0.92	1.07	0.53	
Force Constant @ 25°C±10%	K _f	N/Arms	53.5	26.8	30.9	15.4	89.2	44.6	51.5	25.7	
		lbf/Arms	12.0	6.0	6.9	3.5	20.1	10.0	11.6	5.8	
Mechanical Specifications											
Coil Assembly Weight ±15%	M _c	kg	1.1				1.9				
		lbs	2.5				4.1				
Magnetic Way Type (MCDxxx)			030				050				
Magnetic Way Weight ±15%	M _w	kg/m	2.70				3.93				
		lbs/in	0.15				0.22				
Figures of Merit and Additional Data											
Electrical Time Constant	T _e	ms	2.9				3.2				
Max. Theoretical Acceleration ③	A _{max}	g's	30.7				30.7				
Magnetic Attraction	F _a	kN	1.06				1.78				
		lbf	2.38				400				
Thermal Resistance ④ (Coils to External Structure)	R _{th}	°C/Watt	2.05				1.52				
Max. Allowable Coil Temp. ④	T _{max}	°C	130				130				

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.

② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

ICD10 Low Profile Ironcore Motor Performance Data (Continued)

	Symbol	Units	ICD10075				ICD10100				
Rated Performance											
Peak Force	Fp	N	824				1099				
		lbf	185				247				
Continuous Force @ Tmax ①	Fc	N	246				315				
		lbf	55.3				70.8				
Motor Constant @ 25°C	Km	N/√W	31.3				37.1				
		lbf/√W	7.0				8.3				
Electrical Specifications											
Winding Code ②			A1	A4	A5	A8	A1	A4	A5	A8	
Peak Current	Ip	Arms	7.9	15.8	13.7	27.4	7.9	15.8	13.7	27.4	
Continuous Current @ Tmax	Ic	Arms	1.8	3.7	3.2	6.4	1.8	3.5	3.1	6.1	
Electrical Resistance @ 25°C±10%	Rm	Ohms L-L	12.2	3.0	4.1	1.0	15.4	3.9	5.1	1.3	
Electrical Inductance ±20%	L	mh L-L	42.4	10.6	14.1	3.5	55.8	13.9	18.6	4.6	
Back EMF Constant @ 25°C±10%	Ke	Vpeak/m/s L-L	109.2	54.6	63.1	31.5	145.7	72.8	84.1	42.0	
		Vpeak/in/sec L-L	2.77	1.39	1.60	0.80	3.70	1.85	2.14	1.07	
Force Constant @ 25°C±10%	Kf	N/Arms	134	66.9	77.2	38.6	178	89.2	103	51.5	
		lbf/Arms	30.1	15.0	17.4	8.7	40.1	20.1	23.2	11.6	
Mechanical Specifications											
Coil Assembly Weight ±15%	Mc	kg	2.7				3.4				
		lbs	5.9				7.5				
Magnetic Way Type (MCDxxx)			075				100				
Magnetic Way Weight ±15%	Mw	kg/m	5.48				7.04				
		lbs/in	0.31				0.39				
Figures of Merit and Additional Data											
Electrical Time Constant	Te	ms	3.5				3.6				
Max. Theoretical Acceleration ③	Amax	g's	32.5				33.7				
Magnetic Attraction	Fa	kN	2.66				3.56				
		lbf	598				800				
Thermal Resistance ④ (Coils to External Structure)	Rth	°C/Watt	1.21				1.04				
Max. Allowable Coil Temp. ④	Tmax	°C	130				130				

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.

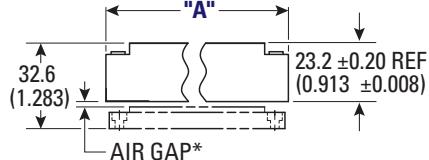
② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

► ICD Low-Profile Ironcore DDL Motors

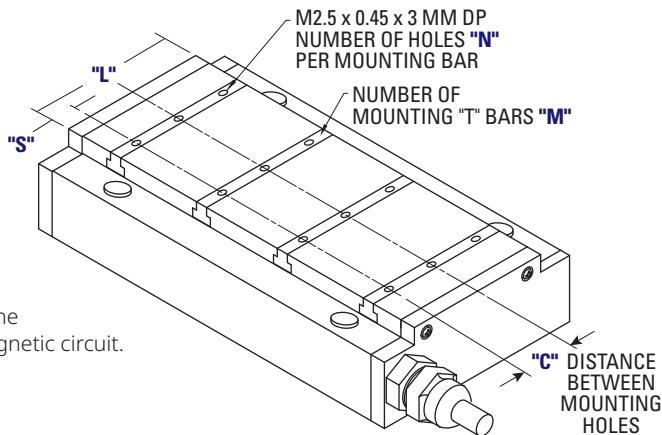
ICDxx Dimensional Drawings and Data



*AIR GAP:

A suitable air gap should be set to ensure that the feeler gauge of the corresponding size can pass smoothly between the coil and the magnetic circuit.

For the covered magnetic circuit, the air gap is 0.6 ± 0.1 mm



ICDxx Dimensional Data, Typical Mounting Bar Lengths & Mounting Holes Tabulation

Motor Coil Type	Coil Width	# Holes	Spacing Between Holes	Mounting Bar Length			
					"A"	"N"	"C"
ICDxx030	55.0 (2.165) ± 1.0 (.04)	3	12.0 (.472)	30 (1.18)	3.0 (.118)		
ICDxx050	75.0 (2.953) ± 1.0 (.04)	4	12.0 (.472)	50 (1.97)	7.0 (2.76)		
ICDxx075	100.0 (3.937) ± 1.0 (.04)	5	16.0 (.630)	75 (2.95)	5.5 (.217)		
ICDxx100	125.0 (4.921) ± 1.0 (.04)	5	20.0 (.787)	100 (3.94)	10.0 (.394)		

Dimensions in mm (in.)

Motor Model	Number of Bars "M"
ICD05XXX	4
ICD10XXX	7

Note:

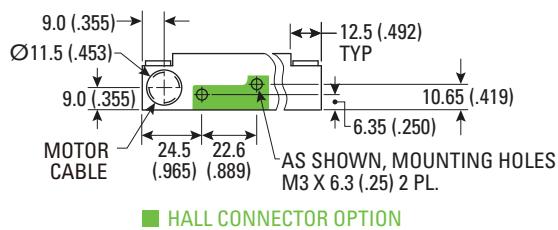
1. Dimensions in mm (inches)
2. Tolerances (unless otherwise specified):

No decimal places: ± 0.8

One decimal place: ± 0.1

Two decimal places: ± 0.05

ICDxx Typical Cable Port and Optional Halls Effect Connector Dimensions



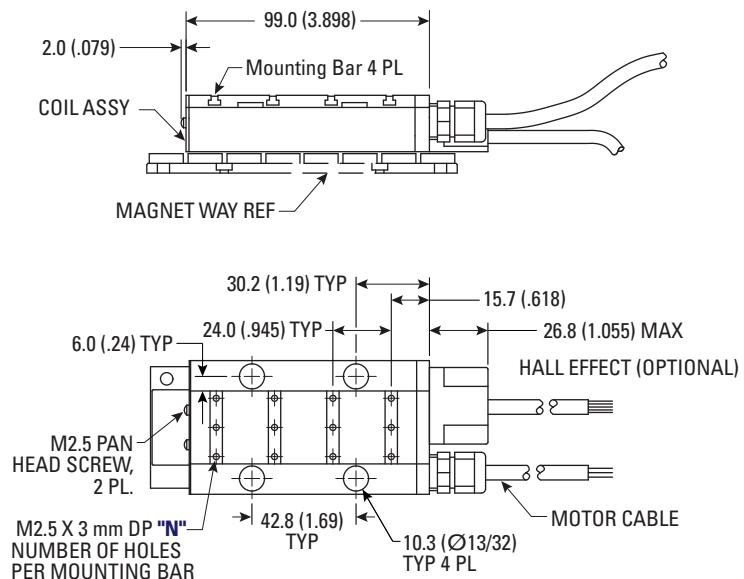
■ HALL CONNECTOR OPTION



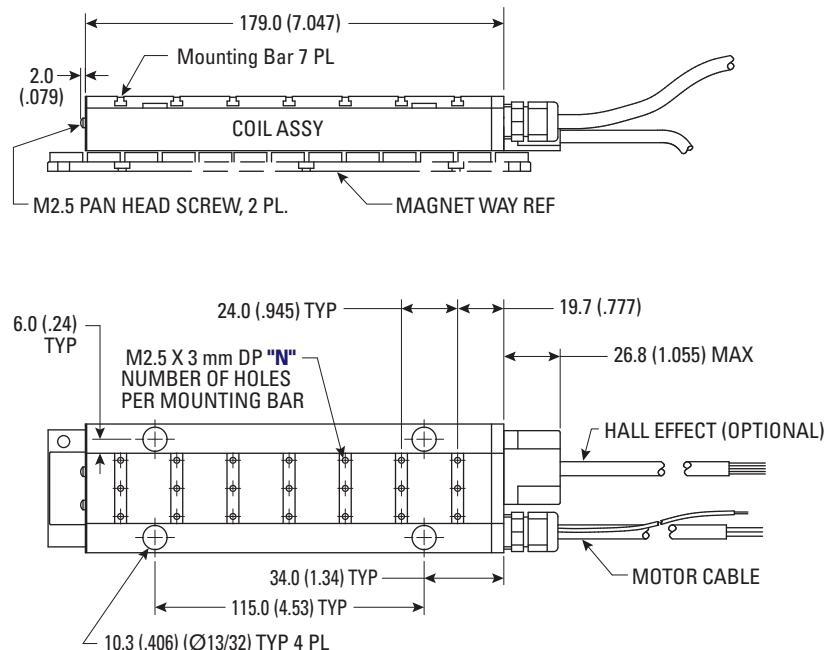
Optional IC Hall Effect Connector Cable

ICDxx Coil Series Dimensional Drawings

ICD05 Ironcore Dimensional Drawings



ICD10 Ironcore Dimensional Drawings

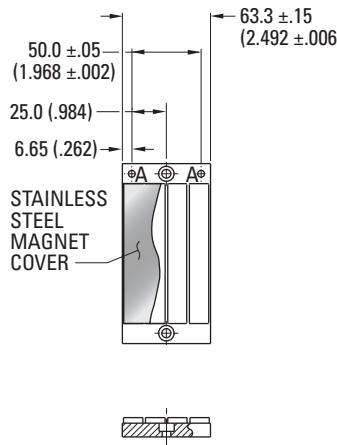


Ironcore Magnet Ways

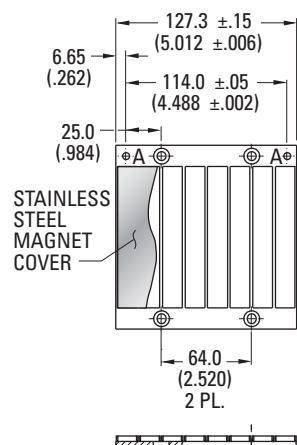
Magnet assemblies are modular and can be installed in multiples of same or alternate lengths (see following page). Standard assembly lengths are shown below.

MC Magnet Ways Dimensional Drawings

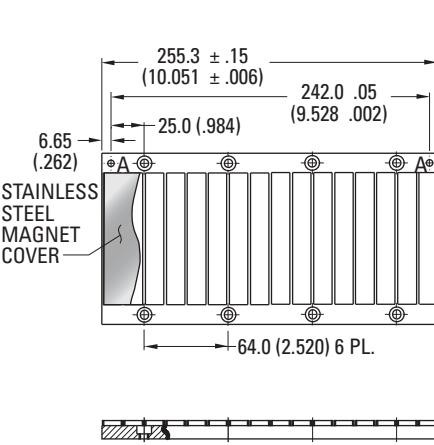
MCxxx-0064



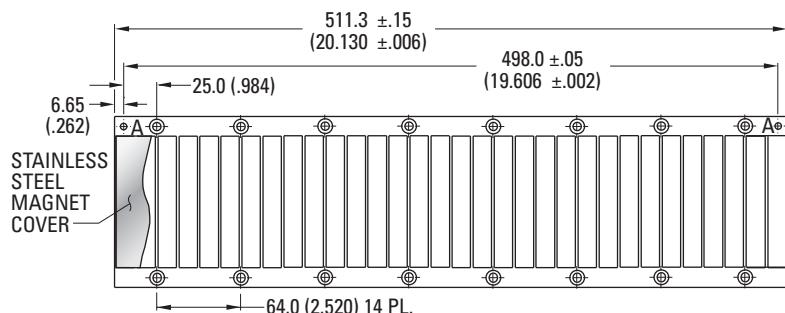
MCxxx-0128



MCxxx-0256



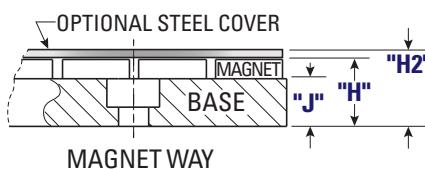
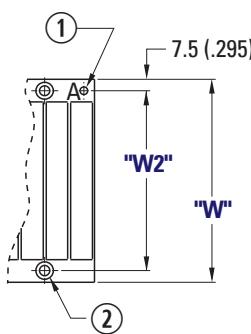
MCxxx-0512



MCxxx Magnetic Way Typical Dimensions

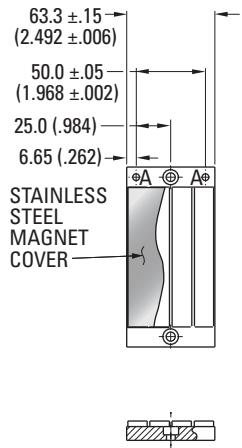
Magnet Way Type	Assembly Width	Mounting Hole Width	Base Height	Base + Magnet Height	Total Height with Cover
	"W" ± .3 (.012)	"W2" ± .10 (.004)	"J"	"H" ± .2 (.008)	"H2" ± .2 (.008)
MC030xxxx	60.0 (2.362)	45.0 (1.772)			
MC050xxxx	80.0 (3.150)	65.0 (2.560)			
MC075xxxx	105.0 (4.134)	90.0 (3.544)	10.0 (0.394)	14.1 (0.555)	14.4 (0.556)
MC100xxxx	130.0 (5.118)	115.0 (4.528)			
MC150xxxx	180.0 (7.087)	165.0 (6.496)			
MC200xxxx	230.0 (9.055)	215.0 (8.464)	12.0 (0.472)	16.1 (0.634)	16.4 (0.645)
MC250xxxx	285.0 (11.22)	270.0 (10.63)			

- Ø5.110-5.135 (.201-.202) THRU 2 PL. MARKED "A" FOR RECOMMENDED 5mm M6 LOCATING PINS
- Ø6.6 (.260) THRU C'BORE Ø11.0 (.433) X 6.2 (.246) DP. 2 PL. LOCATED AS SHOWN. RECOMMENDED MOUNTING HARDWARE: M6 SOC. HD. CAP DIN 912 (1/4" SOC. HD. CAP SCREW)

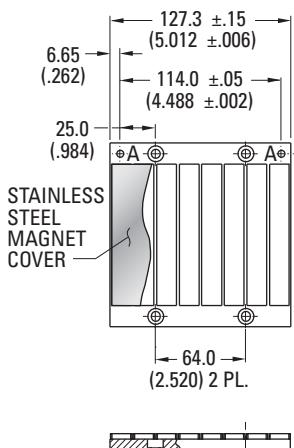


MCD Magnet Ways Dimensional Drawings

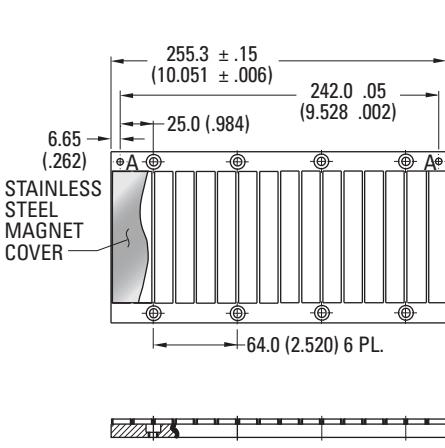
MCDxx-0064



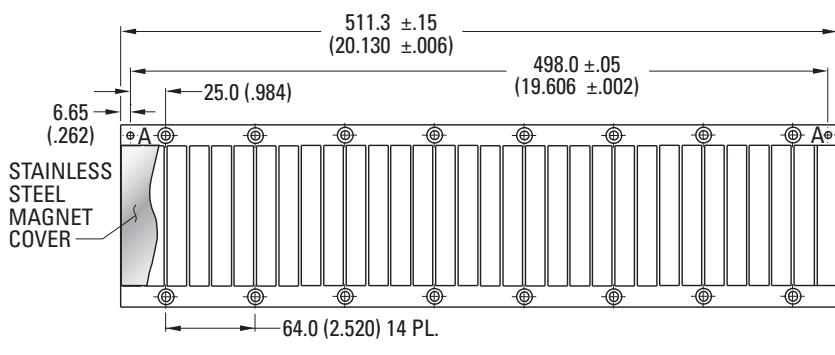
MCDxxx-0128



MCDxxx-0256



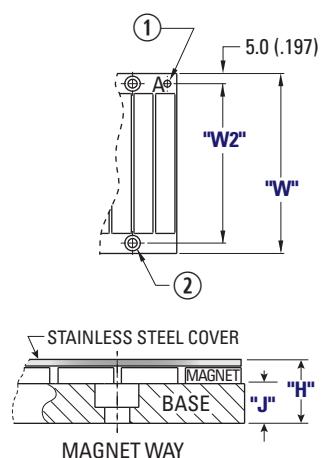
MCDxxx-0512



MCDxxx-xxxx

Type	"W" ± .25 (.010)	"W2" ± .08 (.003)	"J"	"H" ± .25 (.010)
MCD0300xxx001	55.0 (2.165)	45.0 (1.772)		
MCD0500xxx001	75.0 (2.953)	65.0 (2.559)		
MCD0750xxx001	100.0 (3.937)	90.0 (3.543)	4.0 (.157)	8.25 (.325)
MCD1000xxx001	125.0 (4.921)	115.0 (4.528)		

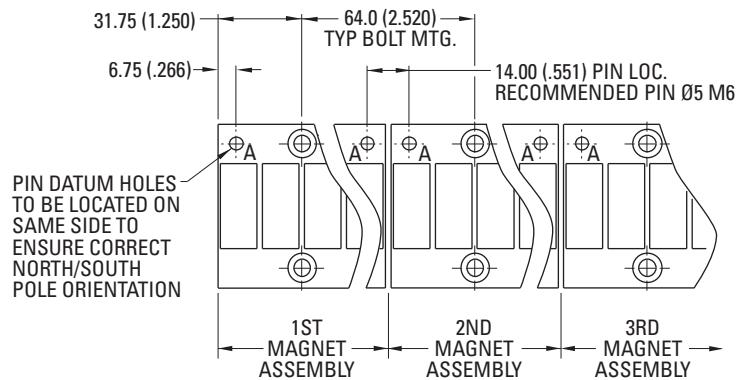
- Ø5.110-5.135 (.201-.202) THRU 2 PL. MARKED "A" FOR RECOMMENDED 5mm M6 LOCATING PINS
- Ø4.7 (.185) THRU C'BORE Ø8.3 (.327) X 1.6^{.025}_{.00} (.063) DP. 2 PL. LOCATED AS SHOWN. RECOMMENDED MOUNTING HARDWARE: M4 SOCKET CAP DIN 912 8-32 SOCKET CAP SCREW



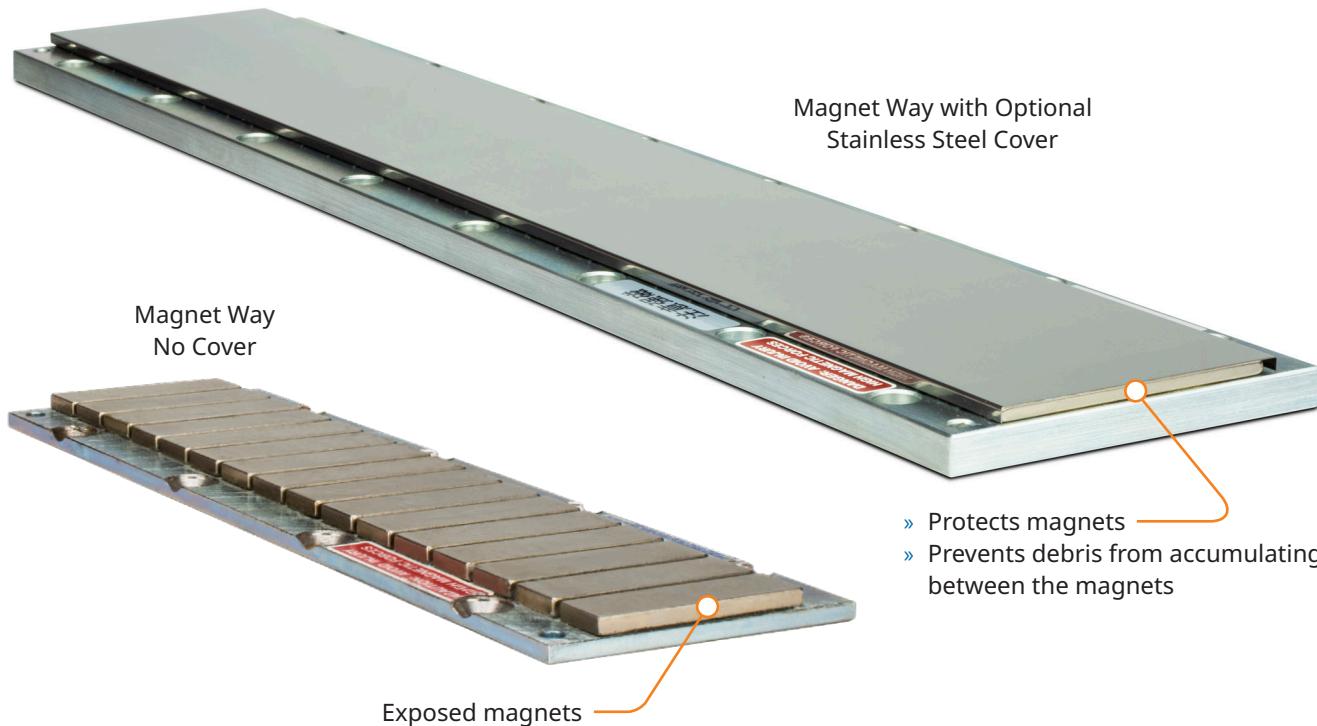
Ironcore Magnet Ways

Typical Installation of Multiple Ironcore Magnet Assemblies

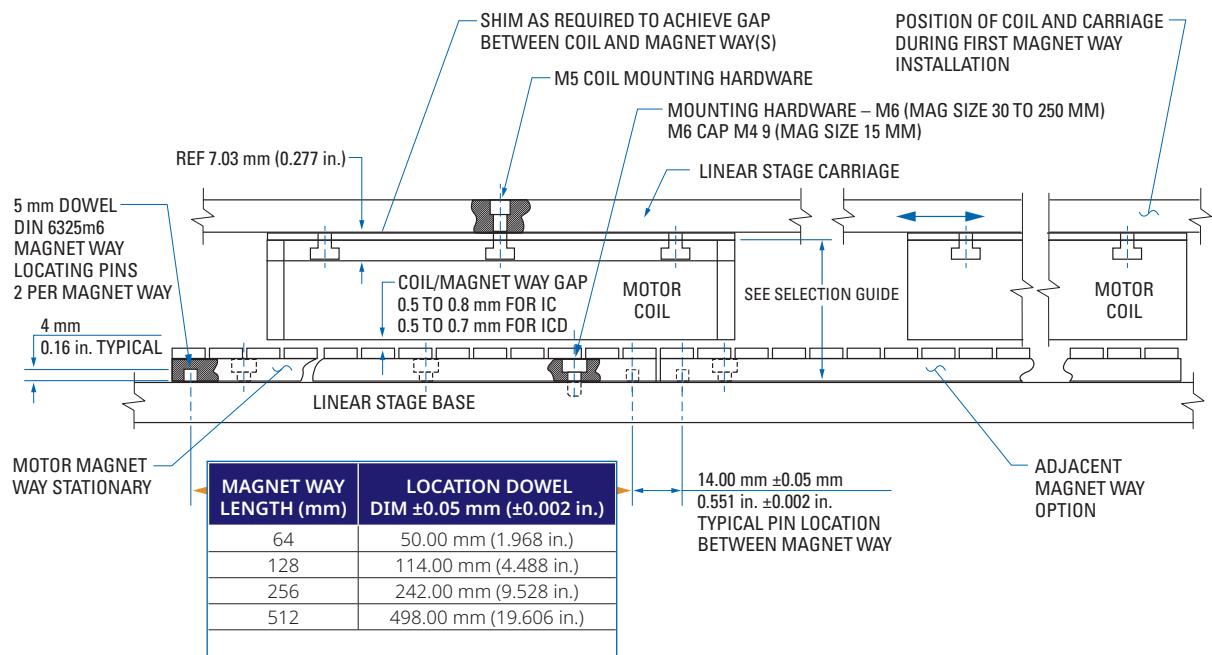
Magnet Way widths correspond to the mating coil assembly width. Magnet Way assemblies are modular and come in standard lengths: 64, 128, 256, 512 mm. Multiple magnet assemblies can be installed to obtain the desired length. Shown below is the method to mount multiple assemblies.



Optional Magnetic Way Stainless Steel Cover



Magnet Way and Ironcore Coil Assembly Overview



IL Ironless DDL Motors

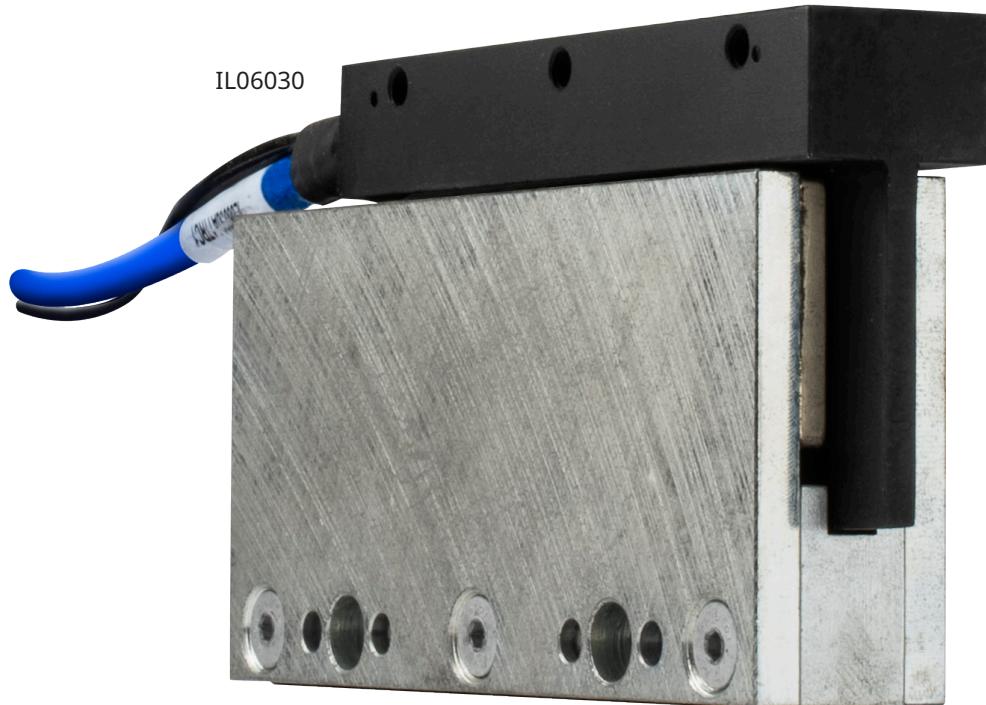
Ironless motors have no iron, or slots for the coils to be wound on. Therefore, these motors have zero cogging, a very light mass, and absolutely no attractive forces between the coil assembly and the magnet way. These characteristics are ideal for applications requiring very low bearing friction, high acceleration of lighter loads, and for maximizing constant velocity, even at ultra low speeds. The modular magnet ways consists of a double row of magnets to maximize the generated thrust force DDL linear motors have a compact profile to provide force moving load.

General Specifications

- » Coil frame size 03, 06, 12, 18, 24
- » Coil width 015, 030, 050, 075, 100
- » Low and high-speed coil winding designs fit various application needs

IL03/06/12/18/24

Peak force range	30 – 1600 N
Continuous force range	10 – 262 N
Insulation voltage rating	230 VAC
Cooling options	Natural-cooled only
Feedback	Optional hall sensor
Thermal Devices	Thermistor – PTC
Certification	RoHS, REACH, UL, CE



REACH ✓



IL03 Ironless Motor Performance Data

	Symbol	Units	IL03015	IL03030	IL03050
Rated Performance					
Peak Force	Fp	N	30	60	100
		lbf	6.74	13.5	22.5
Continuous Force @ Tmax ①	Fc	N	10	19	31
		lbf	2.3	4.3	7.0
Motor Constant	Km	N√W	2.4	3.9	5.6
Electrical Specifications					
Winding Code ②			A1	A1	A1
Peak Current	Ip	Arms	7.2	7.1	7.0
Continuous Current @ Tmax	Ic	Arms	2.5	2.3	2.1
Electrical Resistance @ 25°C±10%	Rm	Ohms L-L	2.1	3.1	4.3
Electrical Inductance ±20%	L	mH L-L	0.25	0.65	1.50
Back EMF Constant @ 25°C±10%	Ke	Vpeak/m/s L-L	3.4	6.9	11.6
		Vpeak/in/sec L-L	0.1	0.2	0.3
Force Constant @ 25°C±10%	kf	N/Arms	4.2	8.4	14.3
		lbf/Arms	0.9	1.9	3.2
Mechanical Specifications					
Coil Assembly Weight ±15%	Mc	kg	0.12	0.14	0.16
		lbs	0.26	0.31	0.35
Magnetic Way Type (MWxxx)			015	030	050
Magnetic Way Weight ±15%	Mw	kg/m	5.1	9.4	12.2
		lb/in	0.29	0.51	0.68
Figures of Merit and Additional Data					
Electrical Time Constant	Te	ms	0.12	0.21	0.35
Max. Theoretical Acceleration ③	Amax	g's	25.5	43.7	63.7
Magnetic Attraction	Fa	kN	0	0	0
		lbf	0	0	0
Thermal Resistance ④ (Coils to External Structure)	Rth	°C/Watt	3.94	3.22	2.52
Max. Allowable Coil Temp. ④	Tmax	°C	130	130	130

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.

② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

IL Ironless DDL Motors

IL06 Ironless Motor Performance Data

	Symbol	Units	IL06015	IL06030	IL06050	IL06075	IL06100					
Rated Performance												
Peak Force	Fp	N	60	120	200	300	400					
		lbf	13.5	27	45	68	90					
Continuous Force @ Tmax ^①	Fc	N	21	30.3	49.7	67.6	82.8					
		lbf	4.72	6.81	11.2	15.2	18.6					
Motor Constant	Km	N·V/W	3.3	5.6	8.0	10.2	12.1					
Electrical Specifications												
Winding Code ②			A1	A4	A1	A4	A1	A4	A1	A4		
Peak Current	I _p	Arms	7.2	14.4	7.1	14.2	7.0	14.0	7.0	14.0		
Continuous Current @ Tmax	I _c	Arms	2.5	4.9	1.8	3.6	1.7	3.5	1.6	3.2	1.5	2.9
Electrical Resistance @ 25°C±10%	R _m	Ohms L-L	4.2	1.1	6.1	1.5	8.6	2.2	11.7	2.9	14.7	3.7
Electrical Inductance ±20%	L	mH L-L	0.50	0.13	1.3	0.33	3.00	0.75	5.00	1.25	7.00	1.75
Back EMF Constant @ 25°C±10%	K _e	Vpeak/m/s L-L	6.9	3.4	13.7	6.9	23.3	11.6	34.9	17.5	46.5	23.3
		Vpeak/in/sec L-L	0.18	0.09	0.35	0.17	0.59	0.30	0.89	0.44	1.18	0.59
Force Constant @ 25°C±10%	k _f	N/Arms	8.4	4.2	16.8	8.4	28.5	14.3	42.8	21.4	57.0	28.5
		lbf/Arms	1.9	0.9	3.8	1.9	6.4	3.2	9.6	4.8	12.8	6.4
Mechanical Specifications												
Coil Assembly Weight ±15%	M _c	kg	0.23	0.27	0.32	0.38	0.45					
		lbs	0.5	0.6	0.7	0.8	1.0					
Magnetic Way Type (MWxxx) L = low profile T = Thinner			015	015T	030	030L	050	050L	075	100		
Magnetic Way Weight ±15%	M _w	kg/m	5.1	4.2	9.4	7.3	12.2	10.2	18.9	27.3		
		lb/in	0.29	0.24	0.51	0.40	0.68	0.56	1.05	1.51		
Figures of Merit and Additional Data												
Electrical Time Constant	T _e	ms	0.12	0.21	0.35	0.43	0.48					
Max. Theoretical Acceleration ③	A _{max}	g's	26.8	45.2	63.6	80.6	90.7					
Magnetic Attraction	F _a	kN	0	0	0	0	0					
		lbf	0	0	0	0	0					
Thermal Resistance ^④ (Coils to External Structure)	R _{th}	°C/Watt	1.97	1.61	1.26	1.04	0.87					
Max. Allowable Coil Temp. ④	T _{max}	°C	130	130	130	130	130					

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
 ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

IL12 Ironless Motor Performance Data

	Symbol	Units	IL12015			IL12030			IL12050			IL12075			IL12100		
Rated Performance																	
Peak Force	Fp	N	120			240			400			600			800		
		lbf	27			54			90			135			180		
Continuous Force @ Tmax①	Fc	N	41			62.1			88.4			119			148		
		lbf	9.22			14.0			19.9			26.8			33.3		
Motor Constant @ 25°C	Km	N·W	4.8			7.8			11.3			14.5			17.2		
Electrical Specifications																	
Winding Code ②			A1	A2	A4	A2	A4										
Peak Current	I _p	Arms	7.1	14.3	28.3	7.1	14.2	28.5	7.0	14.0	28.1	7.0	14.0	28.1	14.0	28.1	
Continuous Current @ Tmax	I _c	Arms	2.4	4.9	9.8	1.8	3.7	7.4	1.6	3.1	6.2	1.4	2.8	5.6	2.6	5.2	
Electrical Resistance @ 25°C±10%	R _m	Ohms L-L	8.5	2.1	0.5	12.2	3.1	0.8	17.2	4.3	1.1	23.3	5.8	1.5	7.4	1.8	
Electrical Inductance ±20%	L	mH L-L	1.00	0.25	0.06	2.60	0.65	0.16	6.00	1.5	0.38	10.0	2.5	0.63	3.5	0.88	
Back EMF Constant @ 25°C±10%	Ke	Vpeak/m/s L-L	13.7	6.9	3.4	27.5	13.8	6.9	46.5	23.3	11.6	69.8	34.9	17.5	46.5	23.3	
		Vpeak/in/sec L-L	0.35	0.18	0.09	0.70	0.35	0.17	1.18	0.59	0.30	1.77	0.89	0.44	1.18	0.59	
Force Constant @ 25°C±10%	K _f	N/Arms	16.8	8.4	4.2	33.7	16.9	8.4	57.0	28.5	14.3	85.5	42.8	21.4	57.0	28.5	
		lbf/Arms	3.78	1.89	0.94	7.6	3.8	1.9	12.8	6.4	3.2	19.2	9.6	4.8	12.8	6.4	
Mechanical Specifications																	
Coil Assembly Weight ±15%	M _c	kg	0.35			0.42			0.52			0.65			0.77		
		lbs	0.8			0.9			1.1			1.4			1.7		
Magnetic Way Type (MWxxx) L = low profile T = Thinner			015	015T	030	030L	050	050L	075			100					
Magnetic Way Weight ±15%	M _w	kg/m	5.1	4.2	9.4	7.3	12.2	10.2	18.9			27.3					
		lb/in	0.29	0.24	0.51	0.40	0.68	0.56	1.05			1.51					
Figures of Merit and Additional Data																	
Electrical Time Constant	T _e	ms	0.12			0.21			0.35			0.43			0.48		
Max. Theoretical Acceleration ③	A _{max}	g's	35.0			58.2			78.4			94.1			106		
Magnetic Attraction	F _a	kN	0			0			0			0			0		
		lbf	0			0			0			0			0		
Thermal Resistance ④ (Coils to External Structure)	R _{th}	°C/Watt	0.984			0.804			0.629			0.519			0.433		
Max. Allowable Coil Temp. ④	T _{max}	°C	130			130			130			130			130		

Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.

IL Ironless DDL Motors

IL18 Ironless Motor Performance Data

	Symbol	Units	IL18015				IL18030				IL18050			
Rated Performance														
Peak Force	Fp	N	180				360				600			
		lbf	40				81				135			
Continuous Force @ Tmax ①	Fc	N	62				92.1				131			
		lbf	13.9				20.7				29.4			
Motor Constant @ 25°C	Km	N·W	5.8				9.7				13.8			
Electrical Specifications														
Winding Code ②			A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Peak Current	I _p	Arms	7.1	14.2	21.3	42.6	7.1	14.3	21.4	42.8	7.0	14.0	21.0	42.1
Continuous Current @ Tmax	I _c	Arms	2.4	4.9	7.3	14.7	1.8	3.6	5.5	11.0	1.5	3.1	4.6	9.2
Electrical Resistance @ 25°C±10%	R _m	Ohms L-L	12.7	3.2	1.4	0.4	18.2	4.6	2.0	0.5	25.7	6.4	2.9	0.7
Electrical Inductance ±20%	L	mH L-L	1.50	0.38	0.17	0.04	3.8	0.95	0.42	0.11	9.00	2.25	1.00	0.25
Back EMF Constant @ 25°C±10%	Ke	Vpeak/m/s L-L	20.7	10.3	6.9	3.4	41.2	20.6	13.7	6.9	69.8	34.9	23.3	11.6
		Vpeak/in/sec L-L	0.53	0.26	0.18	0.09	1.05	0.52	0.35	0.17	1.77	0.89	0.59	0.30
Force Constant @ 25°C±10%	K _f	N/Arms	25.3	12.7	8.4	4.2	50.5	25.3	16.8	8.4	85.5	42.8	28.5	14.3
		lbf/Arms	5.7	2.9	1.9	0.9	11.4	5.7	3.8	1.9	19.2	9.6	6.4	3.2
Mechanical Specifications														
Coil Assembly Weight ±15%	M _c	kg	0.46				0.57				0.72			
		lbs	1.0				1.3				1.6			
Magnetic Way Type (MWxxx) L = low profile T = Thinner			015	015T	030	030L	050	050L						
Magnetic Way Weight ±15%	M _w	kg/m	5.1				9.4				12.2			
		lb/in	0.29				0.51				0.68			
Figures of Merit and Additional Data														
Electrical Time Constant	T _e	ms	0.12				0.21				0.35			
Max. Theoretical Acceleration ③	A _{max}	g's	40.2				64.5				84.9			
Magnetic Attraction	F _a	kN	0				0				0			
		lbf	0				0				0			
Thermal Resistance ④ (Coils to External Structure)	R _{th}	°C/Watt	0.656				0.536				0.419			
Max. Allowable Coil Temp. ④	T _{max}	°C	130				130				130			

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.

② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

IL18 Ironless Motor Performance Data (Continued)

	Symbol	Units	IL18075				IL18100			
Rated Performance										
Peak Force	Fp	N	900				1200			
		lbf	202				270			
Continuous Force @ Tmax ①	Fc	N	173				211			
		lbf	38.9				47.4			
Motor Constant @ 25°C	Km	N·W	17.7				21.0			
Electrical Specifications										
Winding Code ②			A1	A2	A3	A4	A1	A2	A3	A4
Peak Current	I _p	Arms	7.0	14.0	21.0	42.1	7.0	14.0	21.0	42.1
Continuous Current @ Tmax	I _c	Arms	1.4	2.7	4.0	8.1	1.2	2.5	3.7	7.4
Electrical Resistance @ 25°C±10%	R _m	Ohms L-L	35.0	8.8	3.9	1.0	44.2	11.1	4.9	1.2
Electrical Inductance ±20%	L	mH L-L	15.0	3.75	1.67	0.42	21.0	5.25	2.33	0.58
Back EMF Constant @ 25°C±10%	K _e	Vpeak/m/s L-L	105	52.4	34.9	17.5	140	69.9	46.6	23.3
		Vpeak/in/sec L-L	2.66	1.33	0.89	0.44	3.55	1.77	1.18	0.59
Force Constant @ 25°C±10%	K _f	N/Arms	128	64.2	42.8	21.4	171	85.6	57.0	28.5
		lbf/Arms	28.8	14.4	9.6	4.8	38.5	19.2	12.8	6.4
Mechanical Specifications										
Coil Assembly Weight ±15%	M _c	kg	0.91				1.10			
		lbs	2.0				2.4			
Magnetic Way Type (MWxxx)			075				100			
Magnetic Way Weight ±15%	M _w	kg/m	18.9				27.3			
		lb/in	1.05				1.51			
Figures of Merit and Additional Data										
Electrical Time Constant	T _e	ms	0.43				0.48			
Max. Theoretical Acceleration ③	A _{max}	g's	101				111			
Magnetic Attraction	F _a	kN	0				0			
		lbf	0				0			
Thermal Resistance ④ (Coils to External Structure)	R _{th}	°C/Watt	0.35				0.29			
Max. Allowable Coil Temp. ④	T _{max}	°C	130				130			

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

IL Ironless DDL Motors

IL24 Ironless Motor Performance Data

Symbol	Units	IL24015	IL24030	IL24050
Rated Performance				
Peak Force	Fp	N	240	480
		lbf	54	108
Continuous Force @ Tmax①	Fc	N	83	109
		lbf	18.7	24.5
Motor Constant @ 25°C	Km	N·V/W	6.7	11.2
Electrical Specifications				
Winding Code ②			A1	A2
Peak Current	Ip	Arms	7.1	14.2
Continuous Current @ Tmax	Ic	Arms	2.4	4.9
Electrical Resistance @ 25°C±10%	Rm	Ohms L-L	16.9	4.20
Electrical Inductance ±20%	L	mH L-L	2.00	0.50
Back EMF Constant @ 25°C±10%	Ke	Vpeak/m/s L-L	27.5	13.8
		Vpeak/in/sec L-L	0.70	0.35
Force Constant @ 25°C ±10%	Kf	N/Arms	33.7	16.9
		lbf/Arms	7.6	3.8
Mechanical Specifications				
Coil Assembly Weight ±15%	Mc	kg	0.57	0.72
		lbs	1.3	1.6
Magnetic Way Type (MWxxx) L = low profile T = Thinner			015	015T
Magnetic Way Weight ±15%	Mw	kg/m	5.1	4.2
		lb/in	0.29	0.24
Figures of Merit and Additional Data				
Electrical Time Constant	Te	ms	0.12	0.21
Max. Theoretical Acceleration ③	Amax	g's	42.9	68.0
Magnetic Attraction	Fa	kN	0	0
		lbf	0	0
Thermal Resistance ④ (Coils to External Structure)	Rth	°C/Watt	0.49	0.40
Max. Allowable Coil Temp. ④	Tmax	°C	130	130

Notes:

① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.

② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.

③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.

④ Please see the application sizing section for more details on sizing and thermal considerations.

IL24 Ironless Motor Performance Data (Continued)

Symbol	Units	IL24075				IL24100				
Rated Performance										
Peak Force	Fp	N	1200				1600			
		lbf	270				360			
Continuous Force @ Tmax ①	Fc	N	211				262			
		lbf	47.4				58.9			
Motor Constant @ 25°C	Km	N·V/W	20.6				24.4			
Electrical Specifications										
Winding Code ②			A1	A2	A3	A4	A1	A2	A3	A4
Peak Current	Ip	Arms	7.0	14.0	28.0	56.1	7.0	14.0	28.1	56.1
Continuous Current @ Tmax	Ic	Arms	1.2	2.5	4.9	9.9	1.2	2.3	4.6	9.2
Electrical Resistance @ 25°C±10%	Rm	Ohms L-L	46.6	11.7	2.9	0.73	58.9	14.7	3.7	0.92
Electrical Inductance ±20%	L	mH L-L	20.0	5.0	1.25	0.31	28.0	7.00	1.75	0.44
Back EMF Constant @ 25°C±10%	Ke	Vpeak/m/s L-L	140.	69.9	34.9	17.5	186	93.1	46.6	23.3
		Vpeak/in/sec L-L	3.55	1.77	0.89	0.44	4.73	2.37	1.18	0.59
Force Constant @ 25°C ±10%	Kf	N/Arms	171	85.6	42.8	21.4	228	114	57.0	28.5
		lbf/Arms	38.5	19.2	9.6	4.8	51.3	25.6	12.8	6.4
Mechanical Specifications										
Coil Assembly Weight ±15%	Mc	kg	1.17				1.42			
		lbs	2.6				3.1			
Magnetic Way Type (MWxxx)			075				100			
Magnetic Way Weight ±15%	Mw	kg/m	18.9				27.3			
		lb/in	1.05				1.51			
Figures of Merit and Additional Data										
Electrical Time Constant	Te	ms	0.43				0.48			
Max. Theoretical Acceleration ③	Amax	g's	105				115			
Magnetic Attraction	Fa	kN	0				0			
		lbf	0				0			
Thermal Resistance ④ (Coils to External Structure)	Rth	°C/Watt	0.26				0.22			
Max. Allowable Coil Temp. ④	Tmax	°C	130				130			

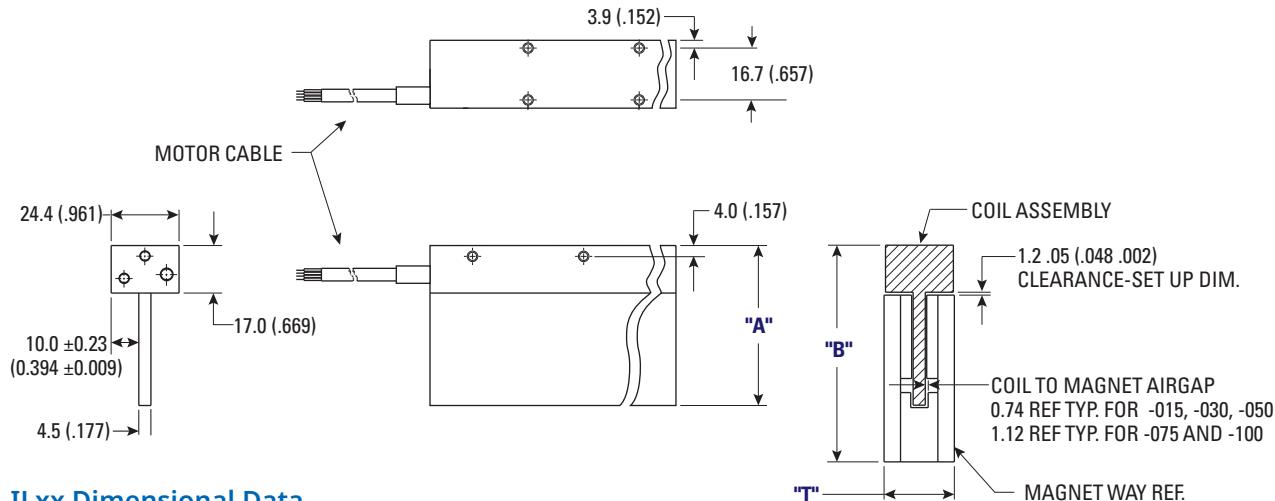
Notes:

- ① The motor continuous rated force is measured with the motor coils achieving the motor maximum allowable temperature Tmax.
- ② Alternate windings can be made available. Please consult Kollmorgen Customer Support for design options.
- ③ Maximum theoretical acceleration is based on the motor's peak force and the motor mass alone. Limitations due to such factors as the additional mass of the load, the bearing type and design, the shock rating of the feedback, and the peak current available from the amplifier etc., must be considered to determine the achievable acceleration in each application.
- ④ Please see the application sizing section for more details on sizing and thermal considerations.

IL Ironless DDL Motors

ILxx Typical Coil Type Dimensional Drawings and Data

ILxx Typical Dimensions



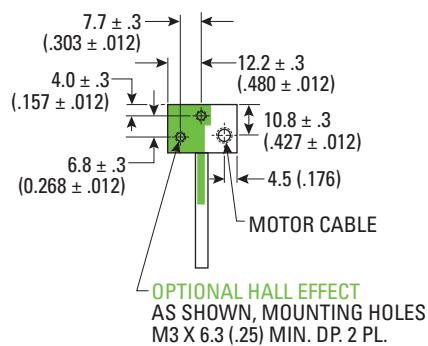
ILxx Dimensional Data

Motor Coil	Coil Width "A" ILxx015: +0.5 (0.020) ILxx030-100: +0.7 (0.027) -0.3 (0.012)	Typ. Assy. Width "B" ±.6 (0.024)	Typ. Assy. Width "T" ±.4 (0.016)
ILxx015	42.30 (1.665)	52.10 (2.051)	25.40 (1.000)
ILxx015 T	42.30 (1.665)	52.10 (2.051)	21.70 (0.854)
ILxx030	57.30 (2.256)	78.50 (3.091)	25.40 (1.000)
ILxx030 L	57.30 (2.256)	67.30 (2.650)	25.40 (1.000)
ILxx050	77.30 (3.043)	98.50 (3.878)	25.40 (1.000)
ILxx050 L	77.30 (3.043)	87.30 (3.437)	25.40 (1.000)
ILxx075	102.30 (4.028)	123.50 (4.862)	30.00 (1.181)
ILxx100	127.30 (5.012)	148.50 (5.846)	34.00 (1.339)

Dimensions in mm (in.)

ILxx Typical Cable Port Dimensions

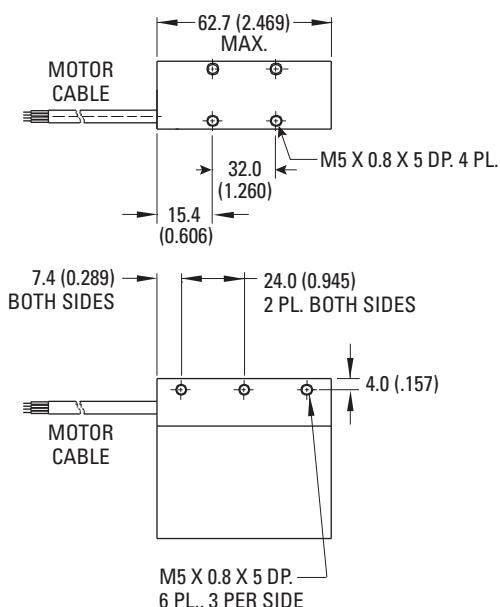
ILxx Cable Ports and Hall Mount



Optional IL Hall Effect Connector Cable

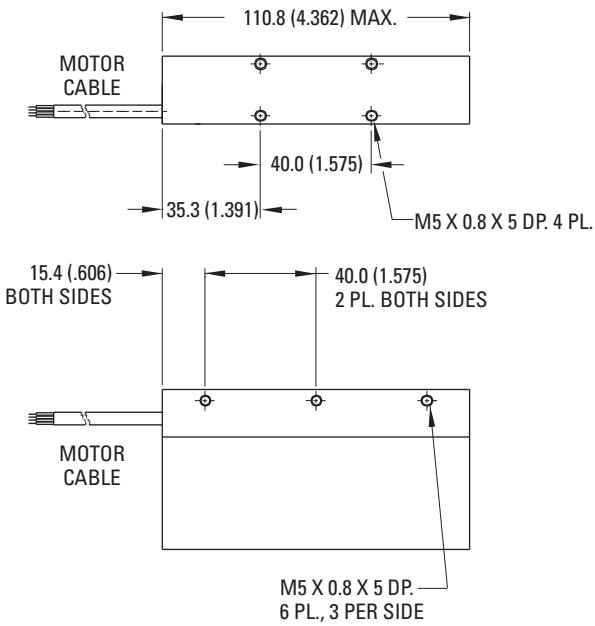
IL Coil Series Dimensional Drawings

IL03 Dimensions

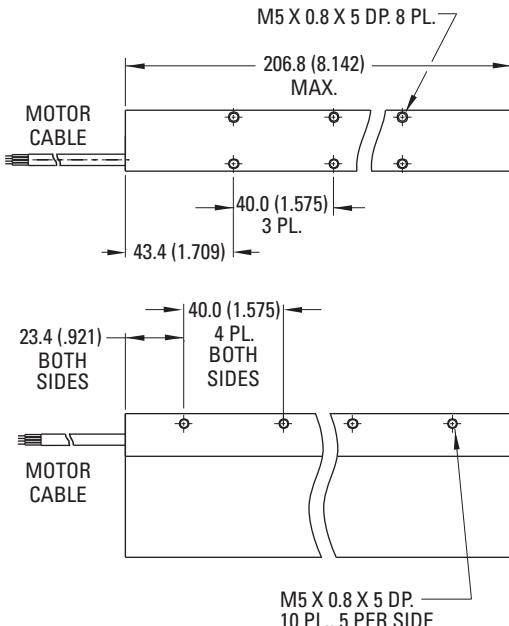


IL Coil Series Dimensional Drawings

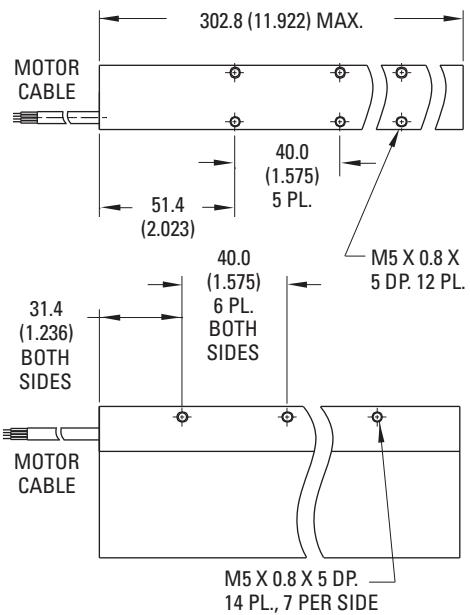
IL06 Dimensions



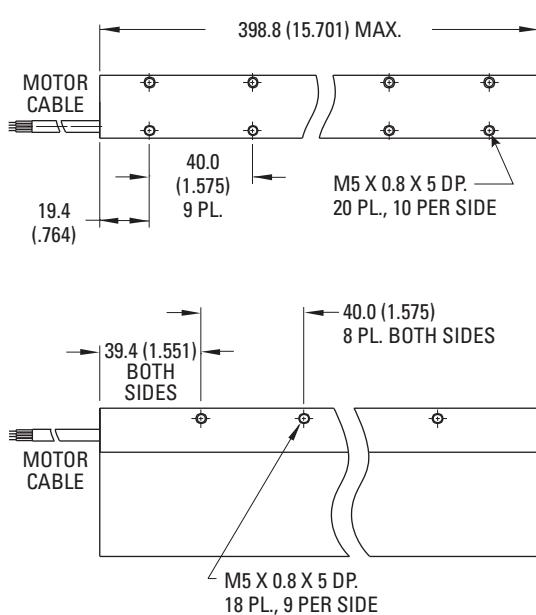
IL12 Dimensions



IL18 Dimensions



IL24 Dimensions



Note:

1. Dimensions in mm (inches)
2. Tolerances (unless otherwise specified):

No decimal places: ± 0.8

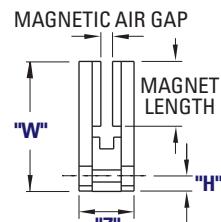
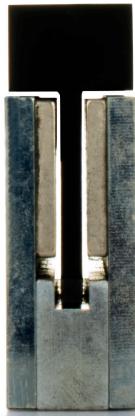
One decimal place: ± 0.1

Two decimal places: ± 0.05

Ironless Magnet Ways

Magnetic Way Dimensional Data

Magnet Way MWxxx-0xxx Standard Dimensions

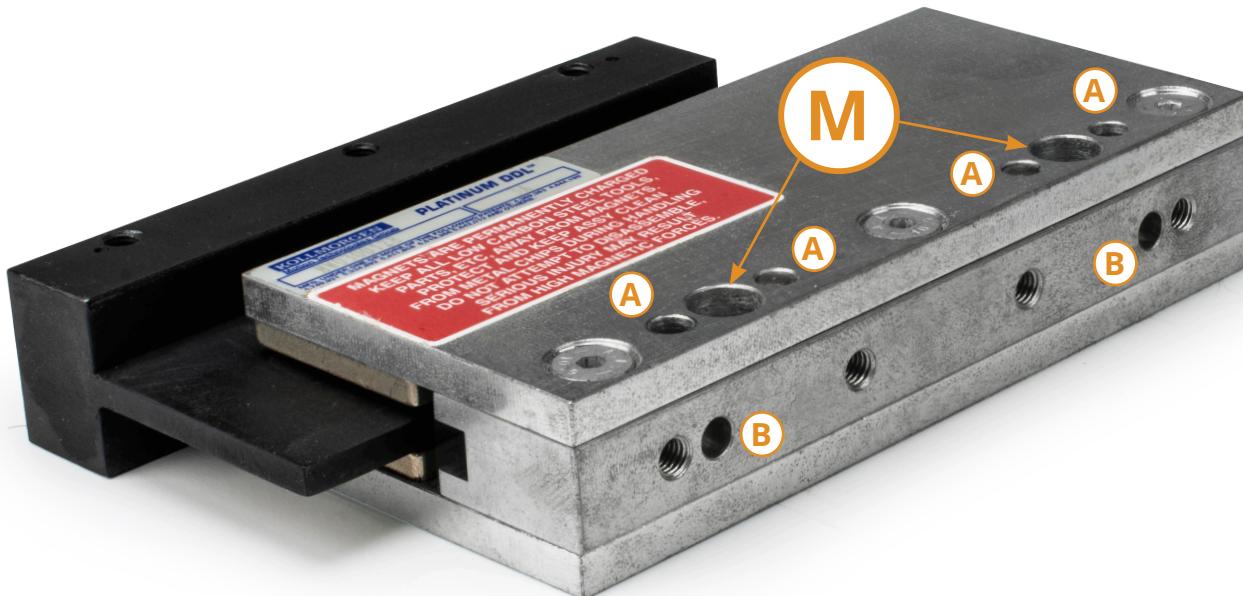


Magnet Way	Magnet Size Reference	"H"	"W"	"Z"
MW0150xxx	15 mm	5.69 (.224)	33.80 (1.331)	25.40 (1.000)
MW015T0xxx	15 mm	5.69 (.224)	33.80 (1.331)	21.8 (0.858)
MW0300xxx	30 mm	7.11 (.280)	60.20 (2.370)	25.40 (1.000)
MW030L0xxx	30 mm	5.69 (.224)	49.00 (1.929)	25.40 (1.000)
MW0500xxx	50 mm	7.11 (.280)	80.20 (3.158)	25.40 (1.000)
MW050L0xxx	50 mm	5.69 (.224)	69.00 (2.716)	25.40 (1.000)
MW0750xxx	75 mm	8.23 (.324)	105.20 (4.142)	30.00 (1.181)
MW1000xxx	100 mm	8.23 (.324)	130.20 (5.126)	34.00 (1.339)

"M" Dimensional Specifications

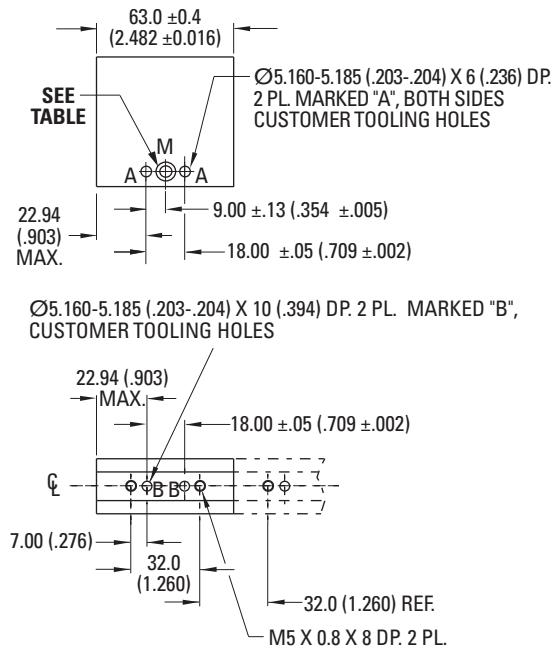
Magnet Way	Hardware (Hex, Socket Head Cap)					
	Hole Dia.	C'bore Dia.	C'bore Depth	Metric	Inch	Bottom Mount Thread Option
	±.13 (.005)	±.13 (.005)	±.13 (.005)			
MW0150xxx	4.70 (.185)	7.80 (.307)	4.00 (.158)	M4	#8	M4 X 0.7 X 6.0 DP.
MW015T0xxx	4.70 (.185)	7.80 (.307)	5.79 (.228)	M4	#8	M4 X 0.7 X 6.0 DP.
MW0300xxx	5.70 (.224)	9.35 (.368)	5.79 (.228)	M5	#10	M5 X 0.8 X 8.0 DP.
MW030L0xxx	4.70 (.185)	7.80 (.307)	5.79 (.228)	M4	#8	M4 X 0.7 X 6.0 DP.
MW0500xxx	5.70 (.224)	9.35 (.368)	5.79 (.228)	M5	#10	M5 X 0.8 X 8.0 DP.
MW050L0xxx	4.70 (.185)	7.80 (.307)	5.79 (.228)	M4	#8	M4 X 0.7 X 6.0 DP.
MW0750xxx	5.70 (.224)	9.35 (.368)	7.95 (.313)	M5	#10	M5 X 0.8 X 8.0 DP.
MW1000xxx	5.70 (.224)	9.35 (.368)	9.96 (.392)	M5	#10	M5 X 0.8 X 8.0 DP.

Dimensions in mm (in.)

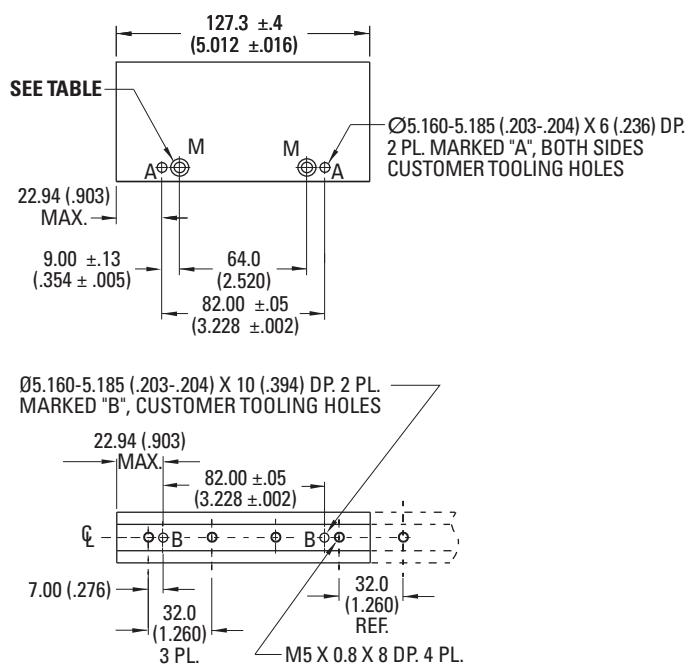


Magnetic Way Dimensional Data (Continued)

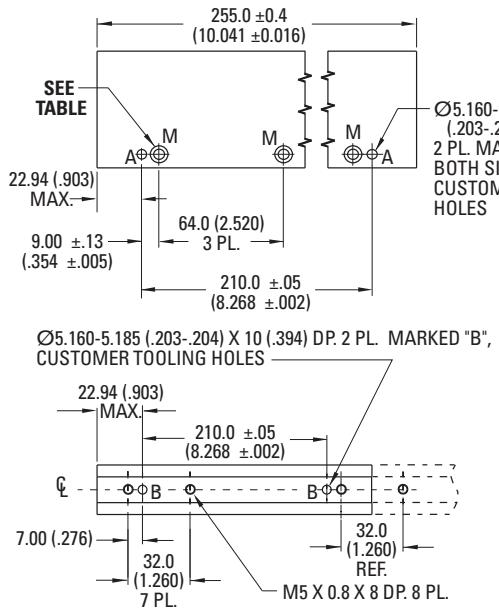
MWxxx-0064 Dimensional Data



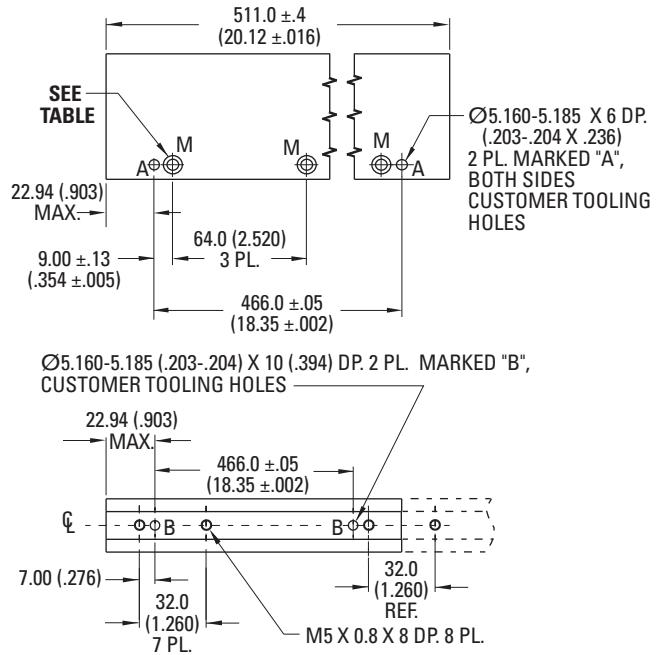
MWxxx-0128 Dimensional Data



MWxxx-0256 Dimensional Data



MWxxx-0512 Dimensional Data



Ironless Magnet Ways

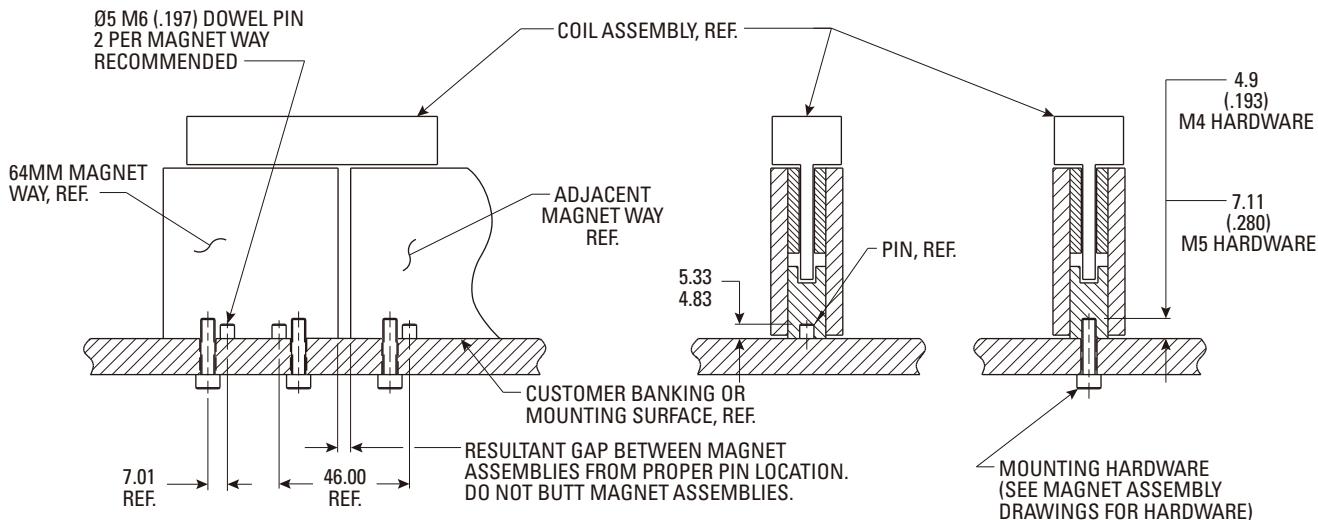
Magnetic Way Assemblies Dimensional Data and Specifications

Magnetic assemblies are modular and can be installed in integer multiples of the same length or alternative lengths.

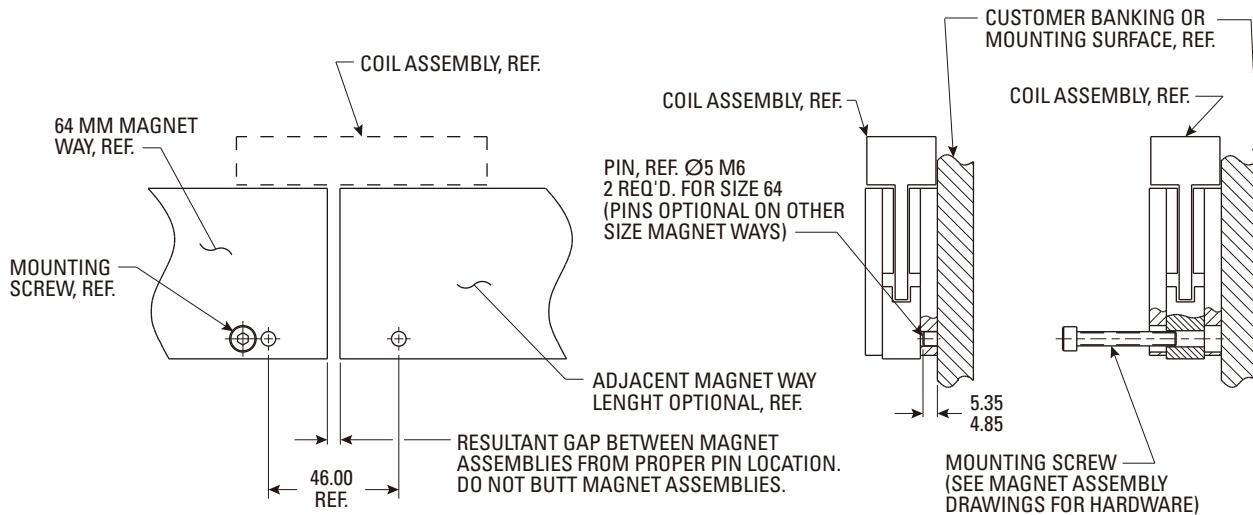
The width of the magnetic circuit corresponds to the width of the matching coil assembly.

The magnetic circuit assemblies are modular and are available in the following standard lengths: 64, 128, 256, 512 mm.

Base Mounting



Side Mounting



Thermal Sensor Protective Devices

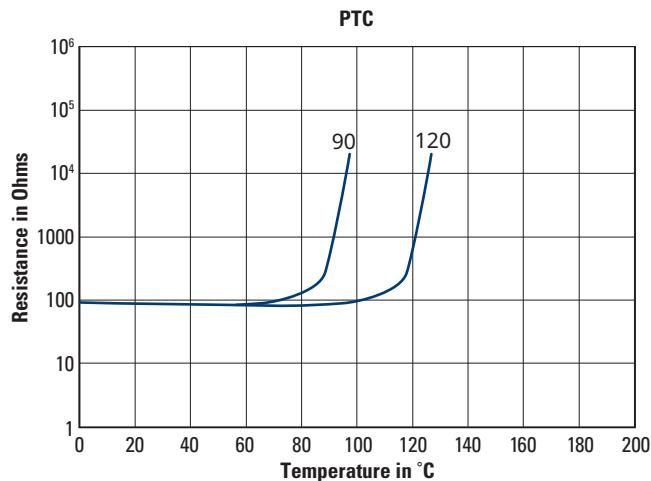
The standard version of each motor is fitted with a choice of an electrically isolated PTC Avalanche-Type thermal sensor, a PT1000 RTD Linear thermal sensor, or a thermostat. The thermal sensors do not provide any protection against short, heavy overloading.

The sensor is integrated into the monitoring system of the digital servo amplifiers with correct connection.

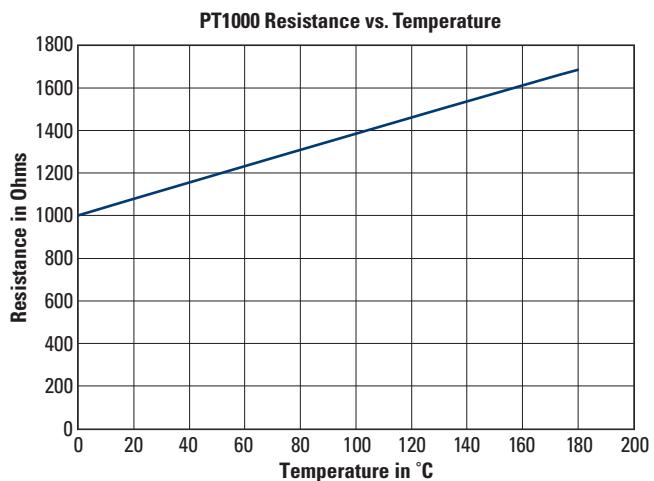
Thermal Device Options: Resistance vs. Temperature Graphs

Kollmorgen AKD drives can directly interpret information from the motor thermal sensors to properly reflect the motor winding temperature. For other drives please refer to the graph Delta Between Motor Winding and Thermal Device on the following page.

Option TR



Option T1



Note: PTC thermistor ($155^{\circ}\text{C} \pm 5^{\circ}\text{C}$ switching temperature) installed.

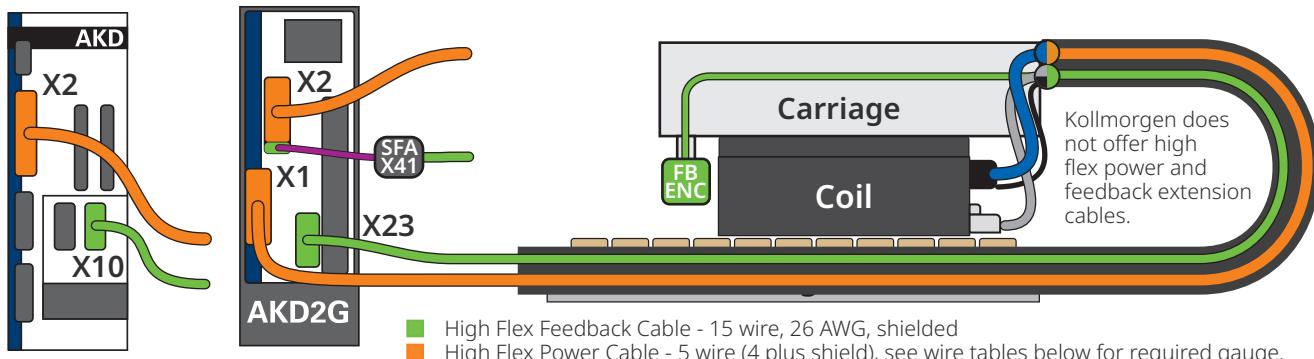
Resistance at 25°C : ≤ 550 ohms.

Switching Resistance: ≥ 1330 ohms within $\pm 5^{\circ}\text{C}$ of switch temperature.

Wiring and Output

DDL to AKD/AKD2G System Wiring

DDL to AKD2G / AKD Connection Via High Flex Extension Cables



AKD and AKD2G power connectors are available through Kollmorgen. Please contact Customer Support for more information.

Wiring Specification Tables for High Flex Extension Cables

Motor Wire Table
SEE TABLE BELOW FOR AWG DIA

Wire Color	Function
-	-
Red	U
White	V
Black	W
Grn/Yel	GND
Violet	Shield

Hall Effect Wire Table
26 AWG 6.0 DIA (.24")

Pin #	Color	Function
1	Red	+5 VDC
2	Orange	S1
3	Yellow	S2
4	Brown	S3
5	Black	Return
Shell	Shield	Shield

Thermal Protection Wire Table
Cable Diameter 3.8 (.15 in.)

Type	Thermostat	Thermistor
Wire Gauge	22 AWG	26 AWG
Code	TS	TR - PTC T1 - PT1000
Wire/Pin #	Color	
1	Black/White	Black/White Blue
2	Black/White	Black/White Blue

Notes:

PTC - Transition point 120°C (IC/ICD) / 90°C (IL)

PT1000 - Linear 180°C max. (IC only)

Note: Ground and shield connection at shell: first make/last break

IC WIRE TABLE NON-COOLED

WINDING CODE	AWG	APPROX. CBL. DIA.
A1	18	6.69 mm (.265 in)
A2	18	6.69 mm (.265 in)
A3	14	7.96 mm (.315 in)
A5	18	6.69 mm (.265 in)
A6	14	7.96 mm (.315 in)
A7	12	8.97 mm (.355 in)

IC WIRE TABLE COOLED (AC)

WINDING CODE	AWG	APPROX. CBL. DIA.
A1	18	6.69 mm (.265 in)
A2	14	7.96 mm (.315 in)
A3	12	8.97 mm (.355 in)
A5	14	7.96 mm (.315 in)
A6	12	8.97 mm (.355 in)

ICD WIRE TABLE

WINDING CODE	AWG	APPROX. CBL. DIA.
ALL (A1 - A4)	22	6.18 mm (.245 in)

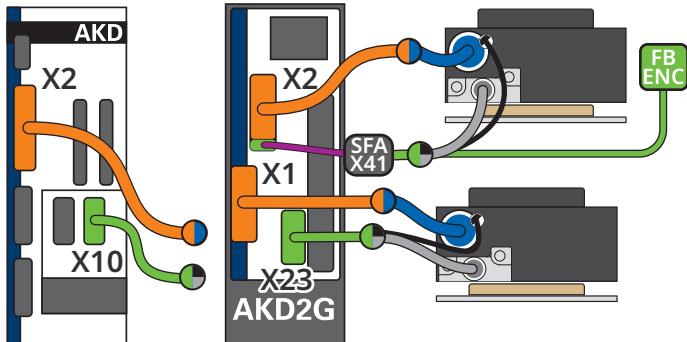
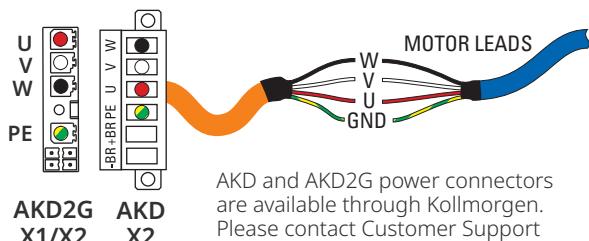
IL WIRE TABLE

WINDING CODE	AWG	APPROX. CBL. DIA.
ALL (A1,A2,A3,A4)	18	6.69 mm (.265 in)



DDL to AKD/AKD2G System Wiring

DDL to AKD2G / AKD Power Connection

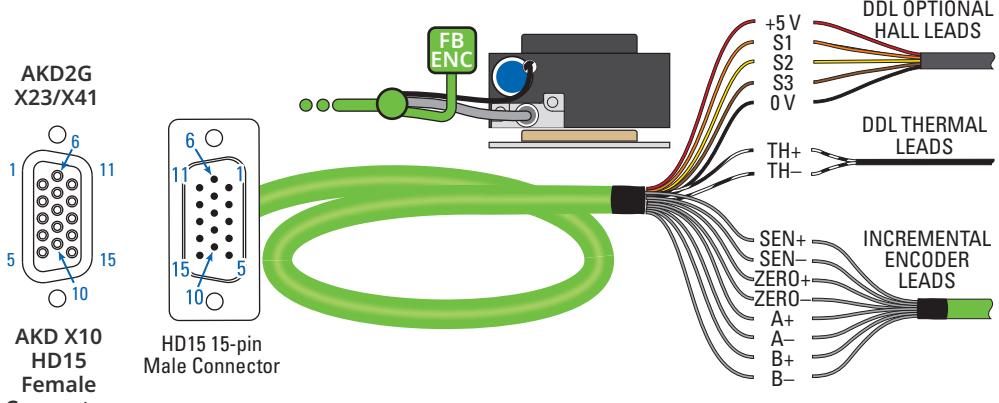


DDL to AKD2G / AKD Hall, Thermal Device, and Feedback Connections

AKD/AKD2G Connector Pinouts to DDL Optional Hall Leads

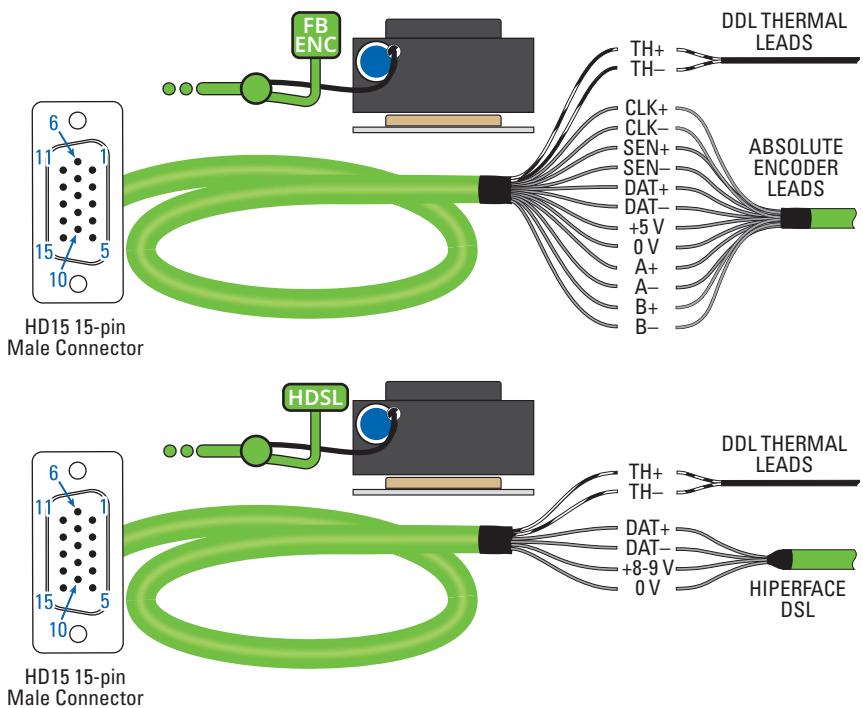
X23/X41 X10 Pin	X23/X41 X10 Pin Label	DDL HALL + TH Leads
1	Hall U	S1
2	Hall V	S2
3	Hall W	S3
8	TH+	TH+
9	TH-	TH-
10	+5 V	+5 V
11	0 V	Return

Hall, Thermal Device, and Optional Feedback Leads to HD15 15-pin AKD/AKD2G Mating Connector



AKD/AKD2G Connector Pinouts to Feedback Leads

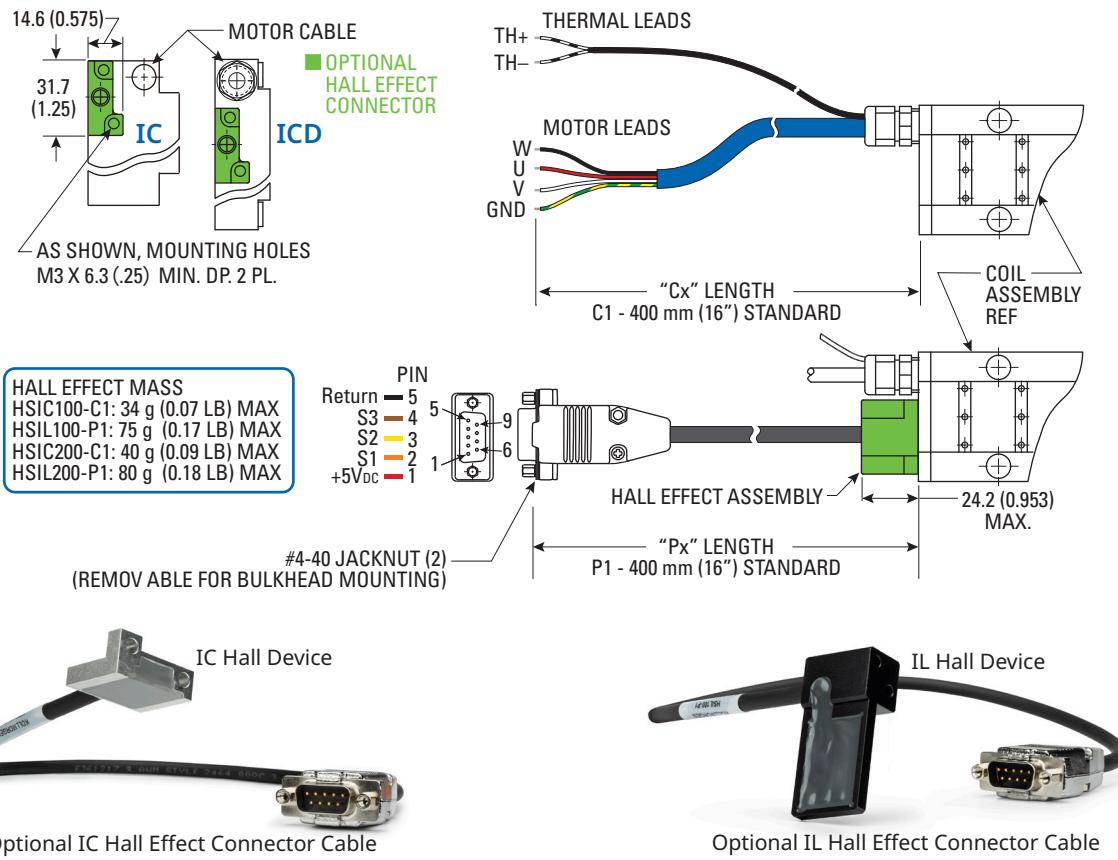
X23/X41 X10 Pin	Optional Incr. Encoder Leads	Optional Abs. Encoder Leads	HIPERFACE DSL
2	-	CLK+	-
3	-	CLK-	-
4	SENSE+	SENSE+	-
5	SENSE-	SENSE-	-
6	Zero+	DAT+	DAT+
7	Zero-	DAT-	DAT-
8	DDL TH+		
9	DDL TH-		
10	-	+5 V	+8-9 V
11	-	0 V	0 V
12	A+	A+	-
13	A-	A-	-
14	B+	B+	-
15	B-	B-	-



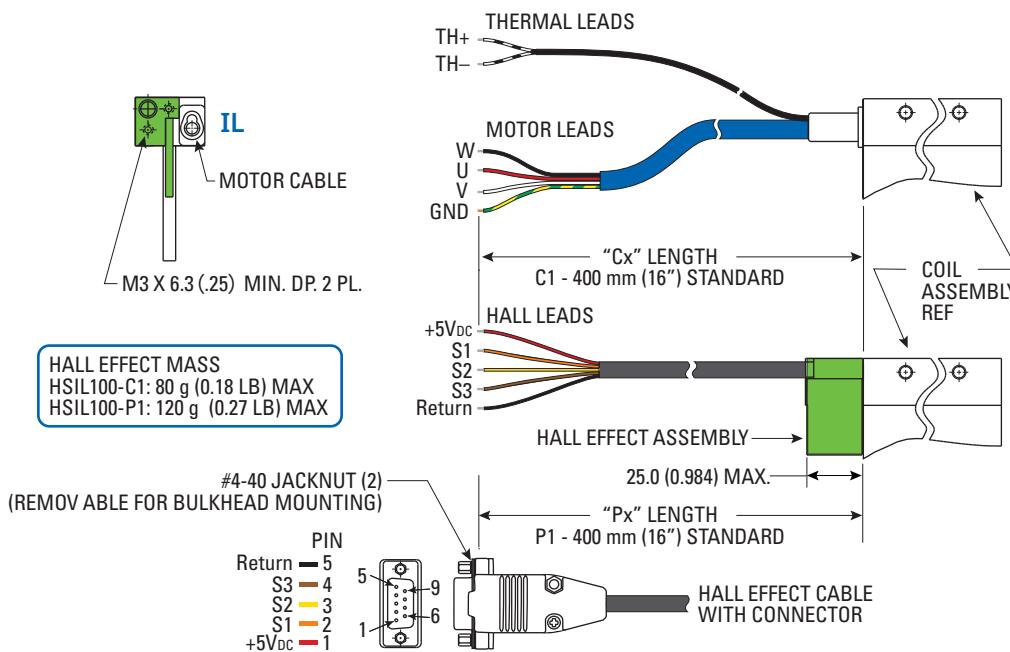
Wiring and Output

Wiring Leads and Connector Specifications

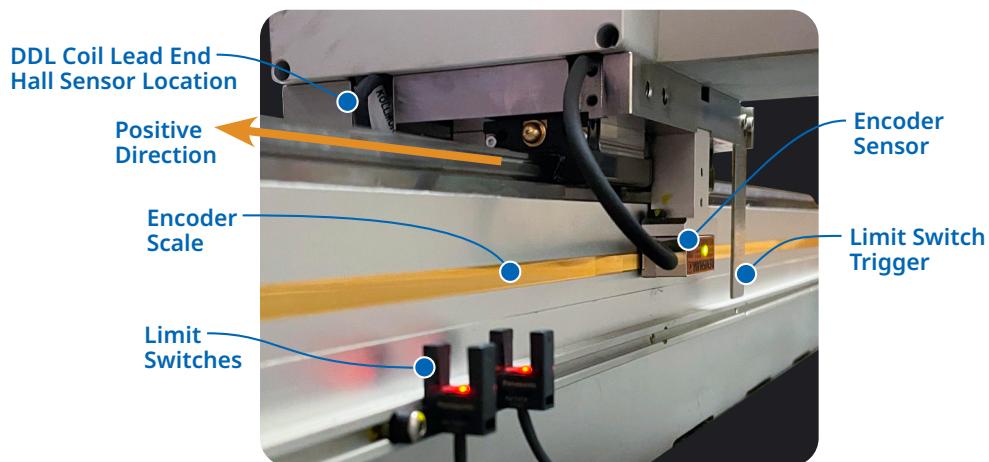
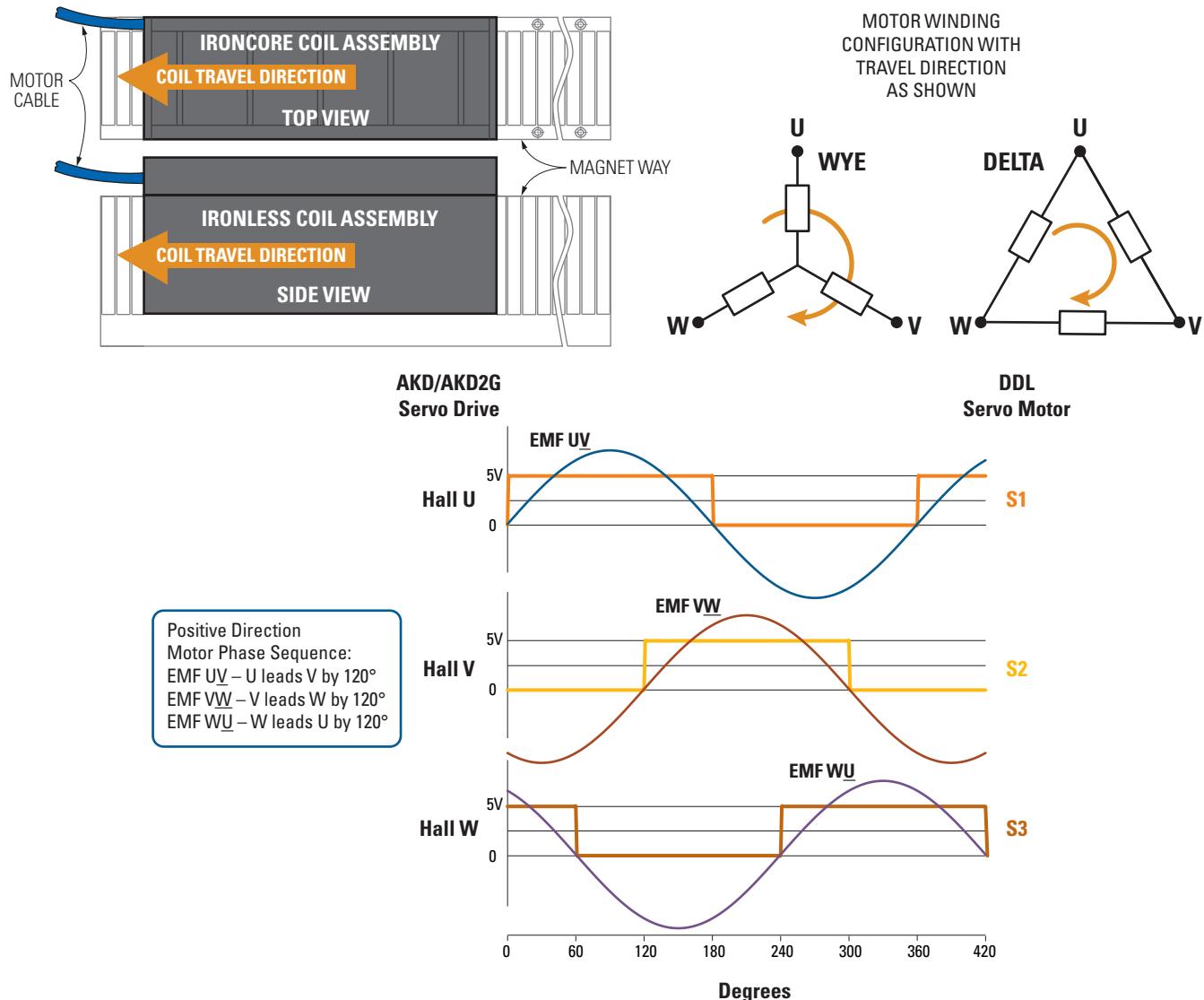
IC/ICD Cable Leads and Hall Effect Connector



IL Cable Leads and Hall Effect Connector



Motor Phasing



Application Sizing

To size a Linear Motor, you will need to:

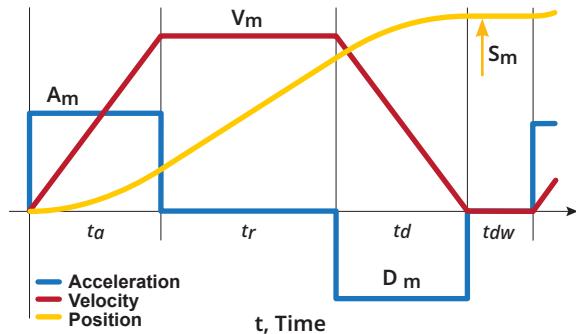
1. Define a Move Profile
2. Define the Load
3. Size the Motor and the Amplifier

From the move profile, we can calculate the maximum speed and the maximum acceleration/deceleration. From the load we can calculate all of the forces at constant speed and using the move profile all the dynamic forces during acceleration and deceleration. Once a motor is selected, the weight of the moving parts of the motor are added to the moving weight to calculate a total Peak Force and a total RMS force. The motor should be able to deliver the peak force and the calculated RMS force should be less than the continuous force to ensure a known safety margin. The coil temperature rise can also be calculated to ensure that it is lower than the intended maximum temperature rise.

The maximum bus voltage and continuous and peak current can also be calculated and compared to the selected amplifier to be sure the calculated performances can be achieved.

1. Defining the Move Profile

Triangular/Trapezoidal



Symbol	Description	Units	
		SI	English
S_m	Move displacement	meters	inches
t_a	Acceleration Time		
t_r	Time run at constant speed	seconds	
t_d	Deceleration Time		
t_{dw}	Dwell Time		
V_m	Max Velocity	meters/sec	inches/sec
A_m	Acceleration	meters/sec^2	inches/sec^2
D_m	Deceleration		

EXAMPLE: Move 0.1 meter in 100 msec assuming $t_a = t_d$ and $t_r = 0$, (assume triangular move)

$$\begin{aligned}\text{Max Speed: } V_m &= 2 \cdot S_m / (t_a + t_d + 2 \cdot t_r) \\ V_m &= 2 \cdot 0.1 / (100E-3) \\ &= 2 \text{ meter/sec}\end{aligned}$$

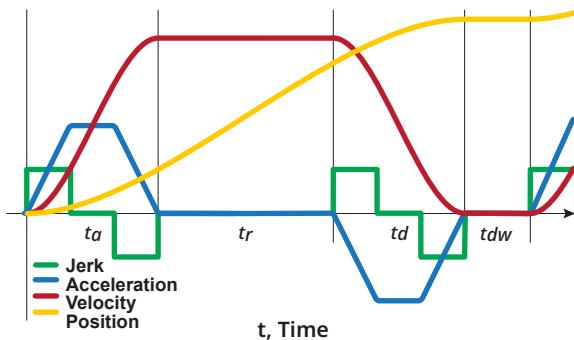
Max Acceleration/Deceleration

$$\begin{aligned}\text{Acceleration: } A_m &= V_m / t_a \\ A_m &= 2 / 50E-3 \\ A_m &= 40 \text{ meter/sec}^2 \\ A_m "g" &= A_m / 9.81 \\ A_m (g) &= 40 / 9.81 \\ A_m &= 4.08 g\end{aligned}$$

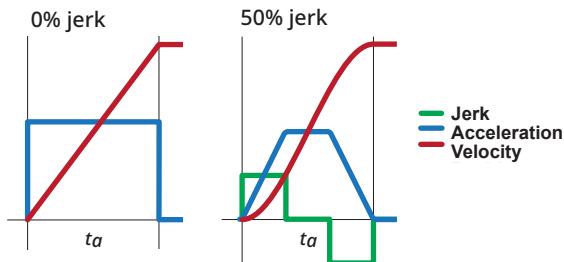
$$\begin{aligned}\text{Deceleration: } D_m &= V_m / t_d \\ D_m &= 2 / 50E-3 \\ &= 40 \text{ meter/sec}^2 \\ D_m "g" &= D_m / 9.81 \\ D_m (g) &= 40 / 9.81 \\ D_m &= 4.08 g\end{aligned}$$

S-Curve and Jerk

If the actual application requires the use of an S-curve, the required peak thrust needs to be increased appropriately according to the magnitude of the Jerk (acceleration).



Analyze the 1/3 trapezoidal motion that joins the S-curve with the following acceleration profile for the first (accelerated) segment (at 50% jerk):



To ensure that the same velocity is achieved in the same amount of time, the required acceleration has the following relationship:

$$a_j = \frac{2}{2-jerk} a_0$$

jerk - the plus acceleration, i.e., the acceleration of the acceleration

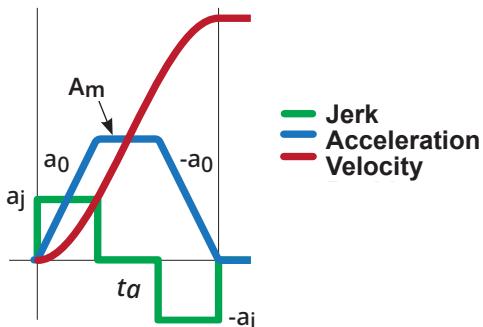
a_0 - the acceleration required for the trapezoidal curve

a_j - the maximum acceleration required with the addition of the S-curve to this basis

At this point, the acceleration force needs to be increased in the same proportion

$$F_{aj} = \frac{2}{2-jerk} F_a$$

F_{aj} - the acceleration force after the addition of the S-curve



2. Determining the Load

Symbol	Description	Units	
		SI	English
F_{ext}	External Force only (Cutting force, etc.)		
F_{acc}	Acceleration Force only		
F_r	Run Force at constant speed	N	lbf
F_{dec}	Deceleration Force only		
F_{am}	Max. Acceleration Force		
F_{dm}	Max. Deceleration Force		
F_{dw}	Dwell Force		
F_{rms}	RMS Force		
μ	Coefficient of Friction (bearing support)	-	-
M_l	Load Mass		
M_c	Coil Mass	kg	lbs
M_{cb}	Counterbalance Mass		
F_a	Magnetic Attraction Force	N	lbf
CB	Counterbalance of load in %	-	-
q	Angle of Linear Displacement (0° = horizontal, 90° = vertical)	degrees	degrees
n	Number of motors in parallel	-	-

BASIC FORMULAS*:

We assume a general case where we have n motors solidly coupled pushing the load and a possible counterbalance weight M_{cb} (Mostly for vertical displacement).

Example of Coefficient of Friction μ :

Linear bearing w/ balls	0.002 - 0.004
Linear bearing w/ rollers	0.005
Steel on oiled steel	0.06
Steel on dry steel	0.2
Steel on concrete	0.3

Counterbalance Weight:

$$M_{cb} = M_l \cdot CB / 100$$

Acceleration Force only:

$$F_{acc} = [(M_l / n) \cdot (1 + CB/100) + M_c] \cdot A_m$$

Run Force at constant speed:

$$F_r = (M_l / n + M_c) \cdot g \cdot \sin(q) + m \cdot \cos(q) - (M_{cb}/n) \cdot g + F_a \cdot \mu + F_{ext}/n$$

where m = mass, g = gravity

Deceleration Force only:

$$F_{dec} = [(M_l / n) \cdot (1 + CB/100) + M_c] \cdot D_m$$

Maximum Acceleration Force:

$$F_{am} = F_{acc} + F_r$$

Maximum Deceleration Force:

$$F_{dm} = F_{acc} - F_r$$

Dwell Force:

$$F_{dw} = (M_l / n + M_c) \cdot g \cdot [\sin(q)] - (M_{cb}/n) \cdot g$$

RMS Force:

$$F_{rms} = \sqrt{\frac{F_{am}^2 \cdot t_a + F_r^2 \cdot t_r + F_{dm}^2 \cdot t_d + F_{dw}^2 \cdot t_{dw}}{t_a + t_r + t_d + t_{dw}}}$$

* All calculations are given in SI units.

For English units use weight in lbs instead of mass • g.

Application Sizing

3. Size the Motor and Amplifier

EXAMPLE:

Moving Weight:	$M_I = 0.5\text{kg}$
Number of Motors:	$n = 1$
Horizontal Move:	$q = 0$
Counterbalance Force:	$M_{cb} = 0$
External Force:	$F_{ext} = 0$
Friction Coefficient:	$\mu = 0.01$

Assume same move as above with a Dwell Time of 50 ms.

Run Force at Constant:	$F_r = 0.5 \cdot 9.81 \cdot 0.01 = 0.05 \text{ N}$
Acceleration Force only:	$F_a = 0.5 \cdot 40 = 20 \text{ N}$
Deceleration Force only:	$F_d = 0.5 \cdot 40 = 20 \text{ N}$
Maximum Accel Force:	$F_{am} = 20 + 0.05 = 20.05 \text{ N}$
Maximum Decel Force:	$F_{dm} = 20 - 0.05 = 19.95 \text{ N}$
Friction Coefficient:	$\mu = 0.01$
Rms Force:	

$$F_{rms} = \sqrt{\frac{(20.05)^2 \cdot (50E-3) + (19.95)^2 \cdot (50E-3)}{100E-3 + 50E-3}} = 16.3 \text{ N}$$

Motor Sizing:

If we select an ironless motor for smoothest possible move we can use Motor IL060-30A1. This motor has a coil mass of 0.21 kg and no attractive force. By adding that weight in the equations above, we need an additional Force of $0.21 \cdot 40 \cdot 0.01 = 0.084 \text{ N}$. So Peak Force is $20.05 + 0.08 = 28.45 \text{ N}$ and RMS force: 23.19 N . This motor will have a safety factor of $(38-23.19) \cdot 100/38 = 39\%$.

Sizing the Amplifier :

Symbol	Description	Units	
		SI	English
I_a	Max Acceleration Current $I_a = F_{am}/K_f$		
I_r	Run Current - At constant speed: $I_r = F_r/K_f$		
I_d	Max. Deceleration Current only $I_d = F_{dm}/K_f$		
I_{dw}	Dwell Current $I_{dw} = F_{dw}/K_f$		
I_{rms}	RMS Current $I_{rms} = F_{rms}/K_f$		
K_f	Force Constant	N/Amp	lbf/Amp
R_m	Motor Electrical Resistance	Ohms L-L	
K_e	Back EMF Constant	Vpk/m/s	Vpk/in/s
V_{bus}	Bus Voltage	VDC	
L	Electrical Inductance	H L-L	

Bus Voltage:

If we assume a sine wave drive with a phase advance ϕ (degrees) and full conduction, the minimum bus voltage (see Fig. 1) is:

$$V_{B1} = 2.4 \text{ (Volts)}$$

$$V_{B2} = K_e \cdot V_m$$

$$V_{B3} = 1.225 \cdot R_{m,\text{hot}} \times I_{rms}$$

$$V_{B4} = 7.6953 \cdot L \cdot I_{rms} \cdot V_m / \text{Pitch}$$

$$\alpha_v = \text{ARCTANGENT}(V_{B4}/V_{B3})$$

$$V_{LR} = \sqrt{V_{B3}^2 + V_{B4}^2}$$

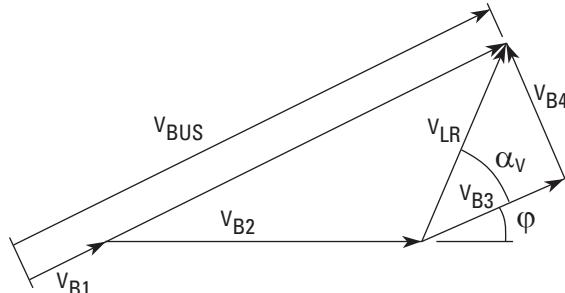
$$V_{bre} = V_{B2} + V_{LR} \cdot \cos(\alpha_v + \phi)$$

$$V_{bim} = V_{LR} \cdot \sin(\alpha_v + \phi)$$

$$V_{BUS} = V_{B1} + V_{bre}^2 + V_{bim}^2$$

Note: If there is no Phase advance take $\phi=0^\circ$.

Figure 1:



Thermal Considerations:

Symbol	Description	Units	
		SI	English
$\Delta\varphi$	Coil increase of temperature	°C	°F
R_{th}	Thermal Resistance	°C/W	°F/W
K_m	Motor Constant	N/ \sqrt{W}	lbf/ \sqrt{W}
P_{out}	Output Power	W	W

Coil Temperature rise:

$$\Delta\varphi = R_{th} \cdot (F_{rms}/K_m)^2$$

Resistance of Coil hot (copper)

$$R_{m,hot} = \frac{R_{ambient} (234.5 + \varphi_{hot})}{(234.5 + \varphi_{hot})}$$

Power Losses:

$$P_{Irms} = \Delta\varphi / R_{th} = \frac{(\varphi_{hot} - \varphi_{ambient})}{R_{th}}$$

Output Power:

$$P_{out(max)} = F_{am} \cdot V_m$$

Example: In above example with:

$$R_{th} = 1.61 \text{ °C/W}$$

$$K_m = 4.7 \text{ N}/\sqrt{\text{W}}$$

Coil Temperature rise: $\Delta\varphi = 1.61 \cdot (23.19/4.7)^2 = 39.2 \text{ °C}$

Power Losses $P_L = 39.2/1.61 = 24.34 \text{ Watts}$

Max output Power $P_{out(max)} = 57 \text{ Watts}$.

The Use of the Motor Constant K_m :

Cognizance of the heat load being generated by the linear motor is an important consideration in the application of any linear motor. Linear motors are direct drive devices, typically mounted very close to the moving load. Therefore, any heat generated by the linear motor needs to be managed to avoid affecting the process or workpiece that the moving load is carrying. The motor constant K_m is a powerful parameter that can be used to determine this heat load.

$K_m = \frac{F}{\sqrt{P_c}}$ where the RMS force F is in Newtons, the RMS heat load P_c is in watts and K_m is in units of $\text{N}/\sqrt{\text{W}}$

The motor constant, K_m , allows us to determine motor performance capabilities such as shown in the following two examples. In the first example, we use K_m to calculate, for a given force, how many watts of generated heat are dissipated by the motor's coil assembly. In the second, we use K_m to determine the maximum RMS force developed by the motor when the dissipated power is limited to some value.

1. An application requires a continuous thrust force of 200 Newtons. The IC11-050 ironcore motor is a good candidate, having a continuous force rating of 276 Newtons and a K_m of $32.0 \text{ N}/\sqrt{\text{W}}$. Therefore, since resistance rises 1.405 times at 130°C from the ambient value at 25°C , and since resistance is the square root denominator of K_m , we must write our equation as follows,

$$\text{Force} = \frac{K_m}{\sqrt{\text{Factor}}} \sqrt{\text{Power (dissipated)}}$$

$$200 = \frac{32.0}{\sqrt{1.405}} \sqrt{\text{Watts}}$$

$$\text{Watts} = 54.9$$

This value of watts is the power or heat generated by the motor. It is interesting to note that for the same application, a larger IC11-100 ironcore motor, with a K_m of $49.1 \text{ N}/\sqrt{\text{W}}$, would dissipate only 23.3 watts for the same force, F.

2. The same application requires that no more than 45 watts are to be dissipated by the motor into the surrounding structure and environment. What is the maximum RMS force that the IC11-050 motor may produce while not exceeding this power limit?

$$\text{Maximum RMS Force} = \frac{32.0}{\sqrt{1.405}} \cdot \sqrt{45} = 181 \text{ N}$$

Therefore, if the motor delivers no more than 181 N of thrust force on an RMS basis, then this same motor will not dissipate more than 45 watts.

Application Sizing

Continuous Force Fc as a Function of Ambient Temperature

In our data sheets the continuous rated force Fc is the RMS force that the motor can supply continuously 100% of the time, assuming the ambient temperature is 25 degrees C and with the coils achieving a maximum temperature of 130 degrees C. At higher (or lower) ambient temperatures, the Fc of the motor must be adjusted by a factor that is determined by the following equation:

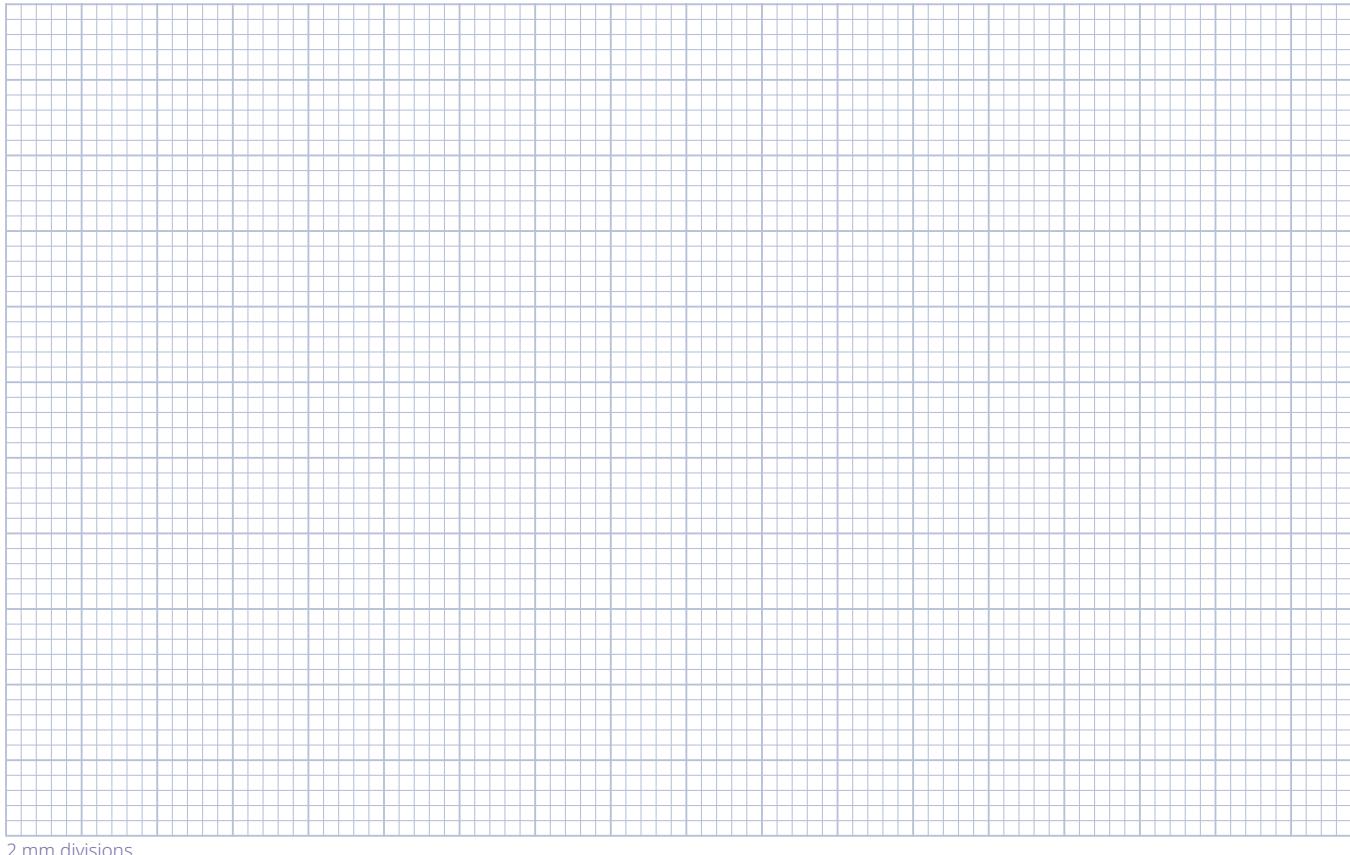
$$\text{Factor} = \sqrt{\frac{(130 - \theta_{\text{Amb}})}{105}}$$

where θ_{Amb} = Ambient Temperature

This factor vs. ambient temperature works out as:

5 °C	10	15	20	25	30	35	40	45
1.091	1.069	1.047	1.024	1	0.976	0.951	0.926	0.900

Notes



2 mm divisions



Application Sizing Worksheet

Customer:	Project Name:
Contact:	Axis Name:
Telephone:	Prepared by:
fax:	E-Mail:

Move

Axis Orientation _____ horizontal vertical
Typical Move _____ mm in
Typical Travel Time _____ mm in
Typical Move Time _____ seconds
Maximum Speed _____ meters/sec inches/sec
Minimum Speed _____ meters/sec inches/sec
Max. Acceleration _____ meters/sec² inches/sec² g
or Accel/Decel Time _____ seconds
Dwell Time _____ seconds
More Profile _____ trapezoidal triangular S-curve

Loads

Friction Coefficient _____
Max Load Mass _____ kg lb
Thrust Force _____ N lbf
Is this thrust present during Accel/Decel? _____ Yes No

Precision

Repeatability _____ μm inch
Absolute Accuracy _____ μm inch
Resolution _____ μm inch

Encoder Feedback

Signal Period _____ μm
Resolution _____ lines/mm lines/in
Electronic Interpolation _____ Yes No If Yes, Multiplication Factor: _____

Environment

Ambient Temperature _____ °C °F
Max Permissible Temperature Rise _____ °C °F
Clean Room Environment _____ Yes No If Yes Class: _____
Is Water or Air Cooling Permissible? _____ Yes No
Vacuum? _____ Yes No Pressure: _____

Amplifier & Power Supply

Max Voltage _____ VDC
Max Current _____ Amps
Power Supply _____ Single Phase Three Phase
Voltage _____ V 50 Hz 60 Hz

AKD Servo Drive Product Family

Experience enhanced system performance, streamlined configuration, and overall piece of mind by pairing your Kollmorgen DDL motor with an AKD drive.



Parameter	AKD2G	AKD	AKD BASIC	AKD PDMM	AKD-N/AKD-C
Base I/O	12 digital 2 analog	11 digital 2 analog	11 digital 2 analog	17 digital 2 analog	5 digital
Expansion I/O ¹	8 digital 2 analog *Drive size is the same	No	20 digital 2 analog *adds 30 mm to the drive width for drives up to 12A	Up to 1000+ remote I/O via EtherCAT	No
Safe I/O	2 digital inputs for Safety option 1 4 digital inputs for SafeMotion options	No	No	No	No
SafeMotion ²	Yes	STO only	STO only	STO only	STO only
Optimized for single cable ³	Yes	No	No	No	Yes
Continuous current limit ⁴	24A	48A	48A	48A	12A
Connectivity ⁵	Analog, EtherCAT, CANopen, Profinet IRT, Ethernet/IP, TCP/IP, Modbus/TCP	Analog, EtherCAT, CANopen, Profinet RT, Ethernet/IP, TCP/IP, Modbus/TCP	Analog	EtherCAT, CANopen, Profinet RT, Ethernet/IP, TCP/IP, Modbus/TCP	EtherCAT
Axis Configuration	single or dual	single	single	single	single
Drive-resident controller	No	No	No	Yes	No
Programmability	parameterized, 2 axes control loops, action table	parameterized	parameterized, BASIC programmable	parameterized, IEC 61131-3 via PLCopen or Pipe Network	parameterized
Graphical Display	160x128-pixel display	2 digit LED	2 digit LED	3 digit LED	Status LED
Removeable Memory ⁶	Yes	No	Yes	Yes	No
System Architecture	Centralized	Centralized	Centralized	Centralized	Decentralized
IP Rating	IP20	IP20	IP20	IP20	IP67 (AKD-N)

Notes:

- 1: Add EtherCAT multi-axis master, PCMM, to the AKD drive family to enable remote I/O expansion via EtherCAT. PCMM controller functionality is built into the PDMM
- 2: SafeMotion includes FS0E, STO, SS1, SS2, SOS, SDB, SBC/SBT, SLS, SSR, SSM, SDI, SAR, SLA, SLI, SLP, SCA up to SIL3 / PLe
- 3: Single cable optimized means one single cable for power & motor feedback with 1 connector at motor end and 1 connector at drive end
- 4: Higher power variants under development in some models. Consult factory for availability.
- 5: Consult factory on connectivity options for AKD2G. Profinet and Ethernet/IP will be added in 2021
- 6: Optional integrated SD card for easy backup and drive cloning

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Quickly choose the ideal products for your application needs.



Motioneering[®]
Size your motion system based on application requirements and motion profiles.



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Optimize housed and frameless motor windings based on power and environmental factors.



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Visualize products in 3D and download CAD files for use in your design.



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Interactively choose the most efficient stepper solution for your application.



AKD2G Safe Dynamic Brake Calculator
Specify and size the right braking components while saving development time.



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About Kollmorgen

Kollmorgen, a Regal Rexnord brand, has more than 100 years of motion experience, proven in the industry's highest-performing, most reliable motors, drives, linear actuators, AGV (Automated Guided Vehicle) control solutions, and automation control platforms. We deliver breakthrough solutions that combine exceptional performance, reliability and ease of use, giving machine builders an irrefutable marketplace advantage.

KOLLMORGEN

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